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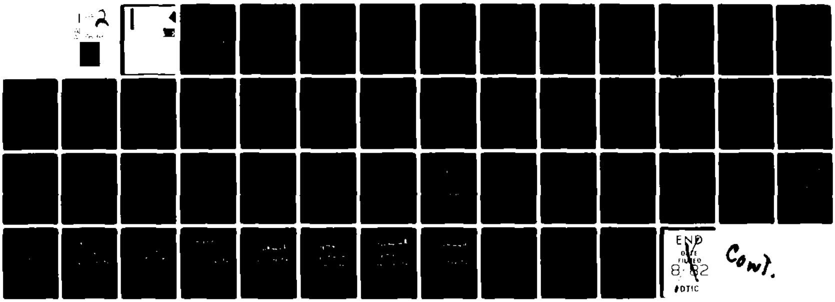

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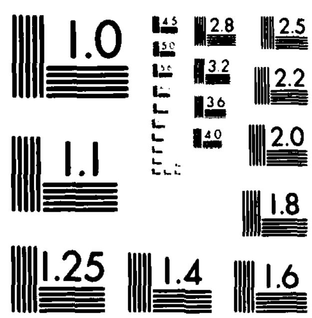

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Basic data from the current meters are presented in statistical tables and graphically as scatter plots, progressive vector plots, spectral plots and time series plots. Filtered time series are shown in composite displays. Time series plots are shown for the inverted echo sounder.

Basic White Horse data are presented as east and north velocity component profiles, potential temperature and salinity profiles, and potential temperature versus salinity diagrams.

WHOI-82-16

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By

Ellen Levy, Ann Spencer, Gerald Needell,
Gretchen Hund and James R. Luyten

Woods Hole Oceanographic Institution
Woods Hole, Massachusetts 02543

April 1982

TECHNICAL REPORT

Prepared for the Office of Naval Research under Contract N00014-76-C-0197; NR 083-400 and for the National Science Foundation under Grant ATM 78-21491.

Approved for Distribution: N.P. Fofonoff

N.P. Fofonoff, Chairman
Department of Physical Oceanography

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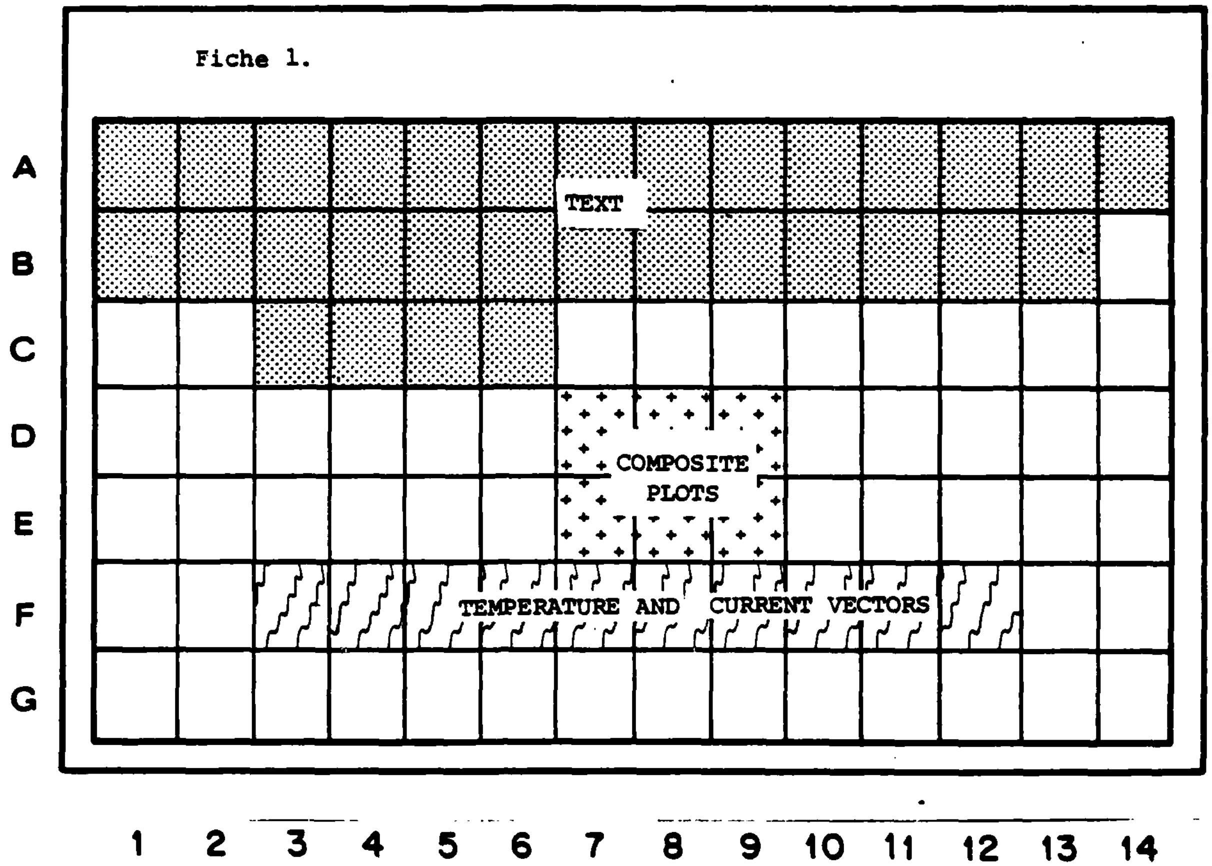

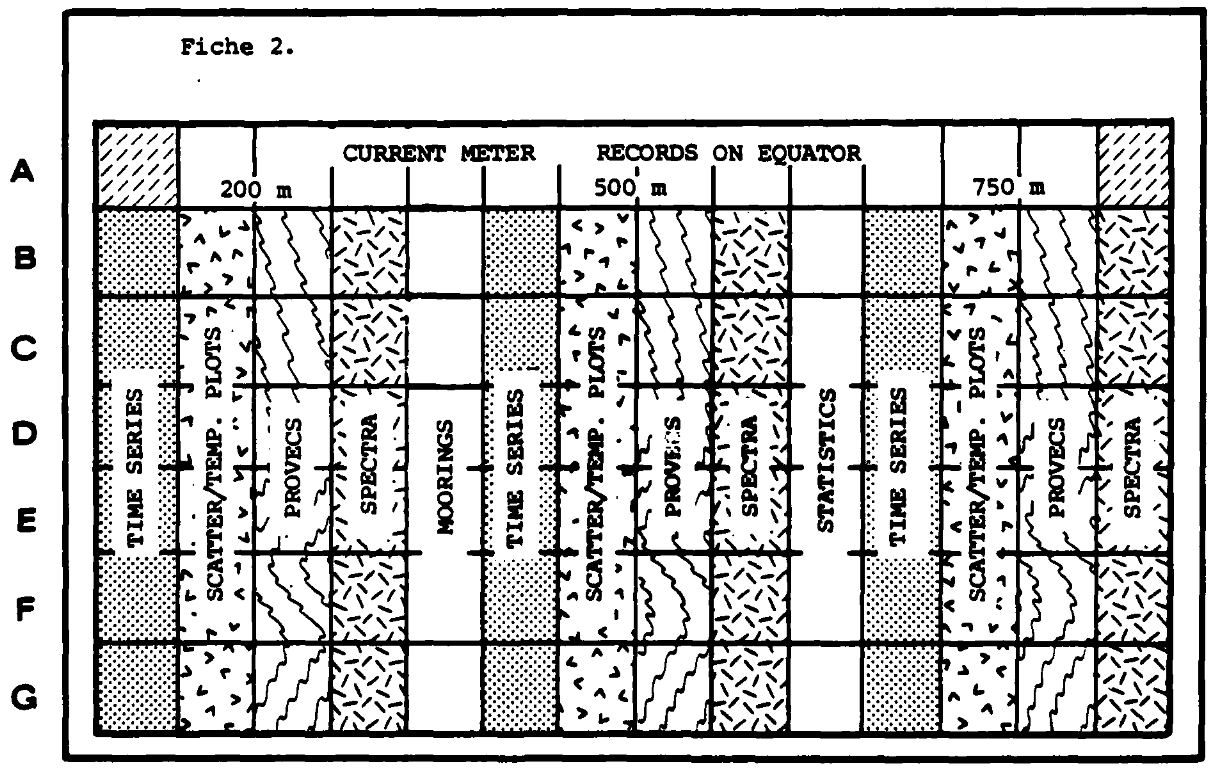

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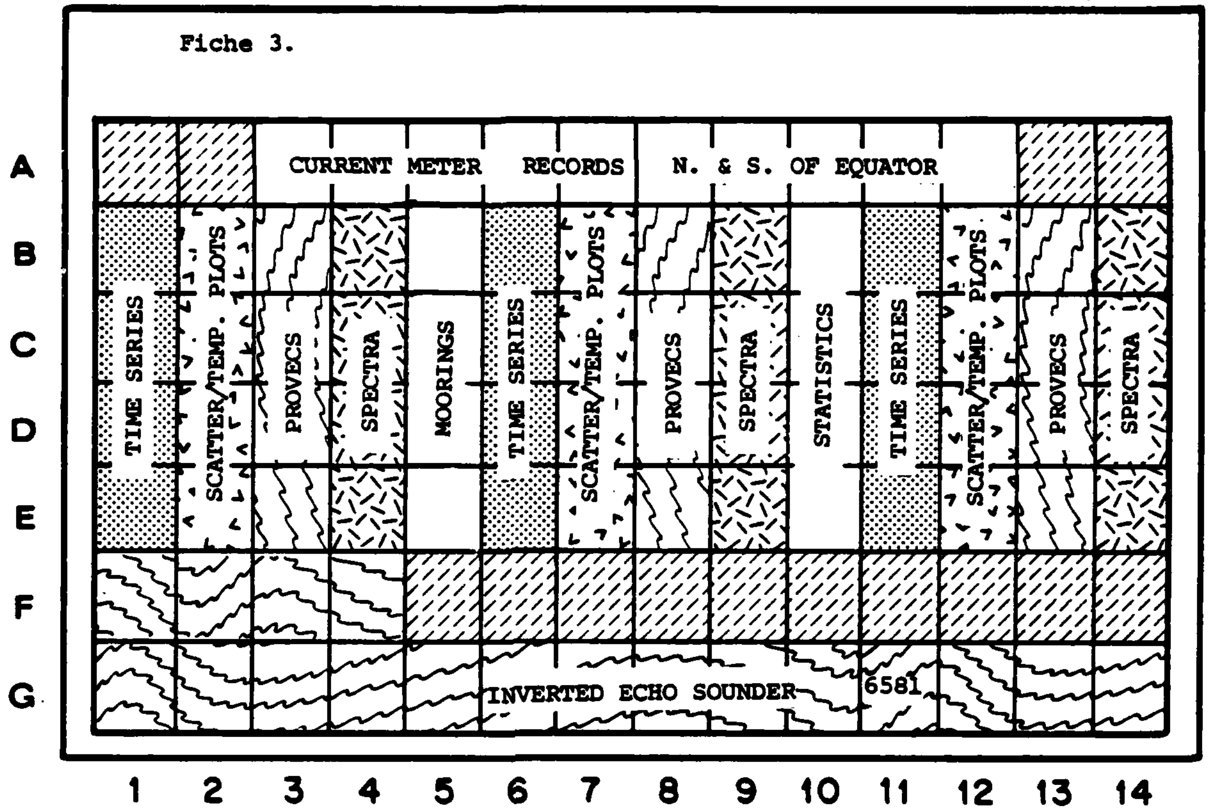

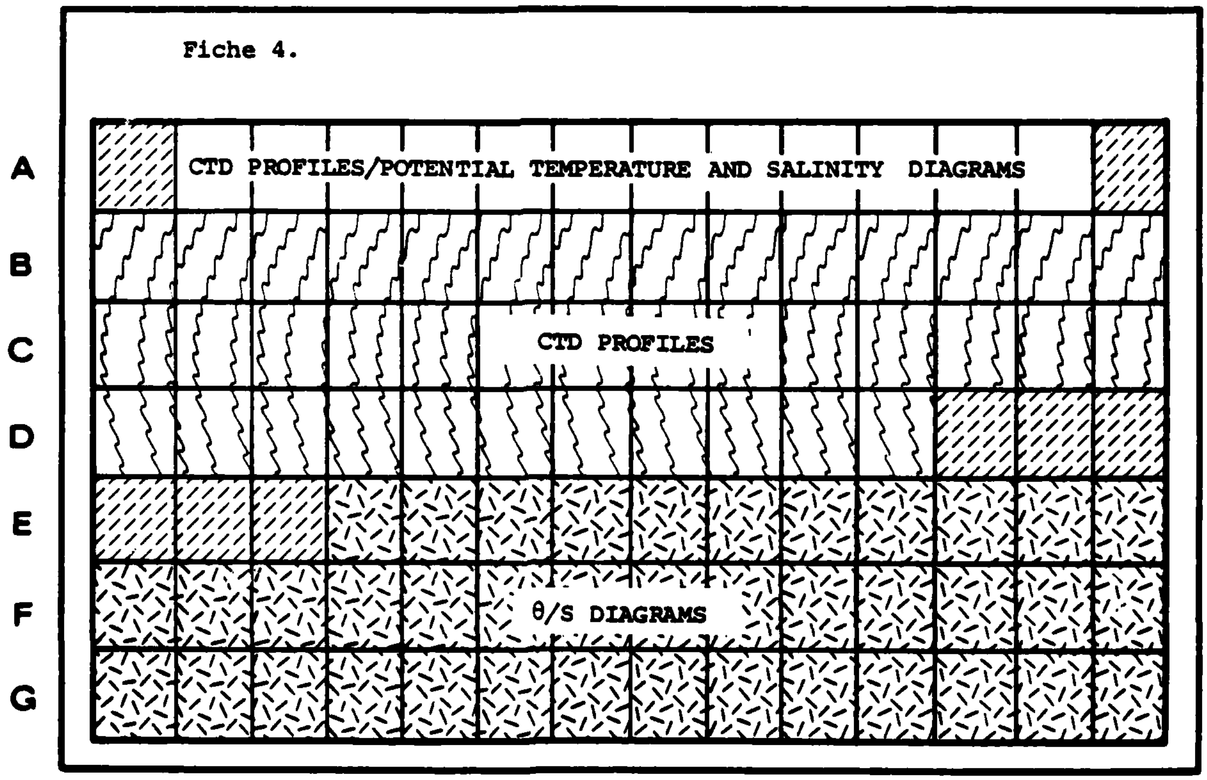

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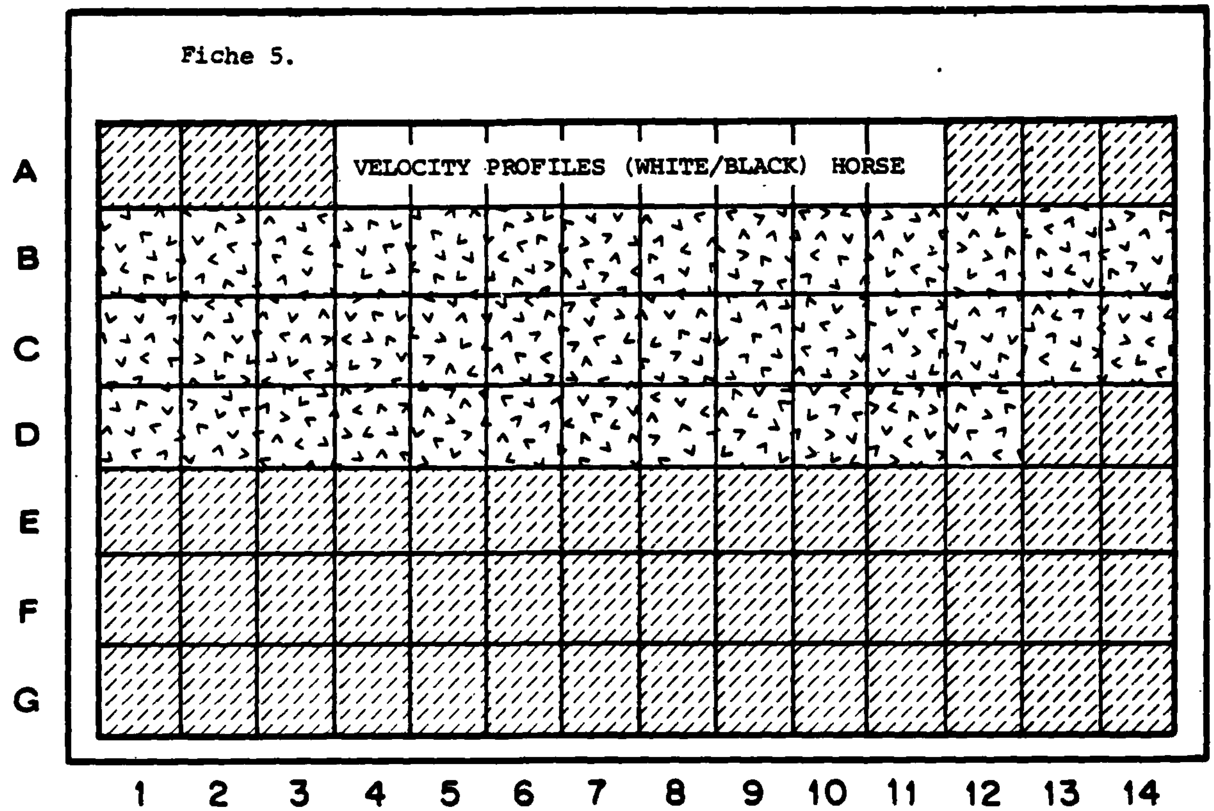


ACKNOWLEDGMENTS

Many people should share the credit for the high quality of data obtained from the instruments set during this experiment; the people in the Buoy Group instrument shop, those who worked on mooring hardware and design, and those who contributed to the development of the White Horse system.

The authors also wish to thank the officers and crew of the R/V Columbus Iselin for their assistance in mooring deployment and those of the R/V Marion Dufresne for their assistance in mooring recovery. Michele Fieux is to be thanked for providing the data from the French mooring.

The experiment was supported jointly by the Ocean Science and Technology Division of the Office of Naval Research (contract number N00014-76-C-0197, NR 083-400) and the National Science Foundation (grant number ATM 78-21491).

PREFACE

This volume is the twenty-ninth in a series of Data Reports presenting moored current meter and associated data collected by the WHOI Buoy Group.

Volumes I-VII present data prior to 1969 and are not listed below.

Volumes I through XXVIII present data obtained during the years 1969-1978, arranged either by year or experiment (see notes).

A data directory and bibliography for the years 1963-1978 has been published, as WHOI Technical Report 79-88.

Volume XXIX presents data from the INDEX Experiment, 1979.

Volume No.	WHOI Ref. No.		Notes Year	Experiment
VIII	75-7	Pollard, R.T. and S. Tarbell	1970	Array Data
IX	75-68	Tarbell, S., M. G. Briscoe and D. Chausse	1973	IWEX Array
X	76-40	Tarbell, S.	1969a	measurements
XI	76-41	Tarbell, S.	1969b	measurements
XII	76-101	Chausse, D. and S. Tarbell	1973	MODE Array
XIII	77-18	Tarbell, S. and A. W. Whitlatch	1970	Measurements
XIV	77-41	Tarbell, S., R. Payne and R. Walden	1976	mooring 592 Saint Croix
XV	77-56	Tarbell, S. and A. W. Whitlatch	1971	measurements
XVI	78-5	Tarbell, S. and A. Spencer	1971-1975	MODE Site
XVII	78-49	Tarbell, S., A. Spencer and R. E. Payne	1975-1977	POLYMODE Array II
XVIII	79-65	Tarbell, S., M. G. Briscoe and R. A. Weller	1978	JASIN
XIX	79-34	Spencer, A., C. Mills and R. Payne	1974-1975	POLYMODE Array I
XX	79-56	Spencer, A.	1974	Rise Array
XXI	79-85	Mills, C. and P. Rhines.	1978	W.B.U.C.
XXII	79-87	Tarbell, S. and R. Payne.	1973	measurements
XXIII	80-40	Tarbell, S. and R. Payne.	1978	POLYMODE Array III
XXIV	80-41	Spencer, A. , K. O'Neill and J. R. Luyten	1976	INDEX
XXV	81-12	Spencer, A., E. D'Asaro and L. Armi	1977	B.B.L. Expt.
XXVI	81-45	Chausse, D. and R. Payne	1972	measurements
XXVII	81-68	McKee, T., E. Francis and N. Hogg	1975,78	topographic expts.
XXVIII	81-73	Mills, C., S. Tarbell, W. B. Owens and R. Payne	1978	L.D.E.

PRESENTATION

The printed portion of the report contains introductory text and information about the instruments and data processing procedures. Tables and figures give summaries of the location of the instruments. Data are shown graphically in numerous composite displays.

These pages are also reproduced on Sheet 1 of the microfiche. Sheets 2 and 3 contain displays of the basic current meter data, including spectral plots, tables of statistics, time series plots, progressive vector diagrams and scatter plots. Sheet 3 also contains the inverted echo sounder plots.

The White Horse CTD profiles and θ/S diagrams are shown on sheet 4, and velocity profiles are shown on sheet 5.

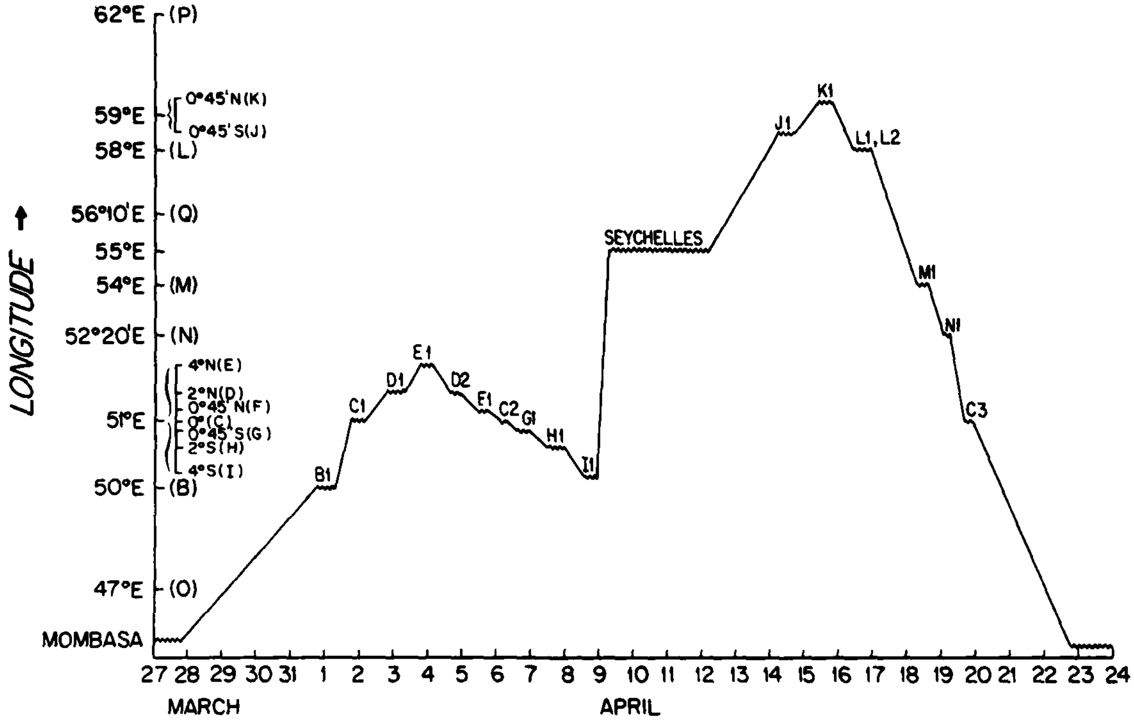
A detailed layout of the data on the microfiche sheets is shown on pages iii through v.

INTRODUCTION

Twelve moorings, with a total of 34 current meters and one inverted echo sounder were set in March and April 1979 and recovered in May 1980. Figure 1 shows the tracks of the Columbus Iselin on leg 1 and leg 2 of mooring deployment. Forty-one velocity and CTD profiles were made with the White Horse and Black Horse acoustic dropsondes between 31 March and 27 June 1979. See figures 1 through 3, and tables 1 through 3 and 5 through 6 for instrument locations, components and data quality. The data were collected as a contribution to the INDEX-79 experiment, a component of the First GARP Global Experiment (FGGE).

Scientific analyses of the data from this experiment have appeared in: Luyten and Roemmich (1982), Luyten (1982) and Luyten, Fieux and Gonella (1980).

COLUMBUS ISELIN, INDEX LEG 1



COLUMBUS ISELIN, INDEX LEG 2

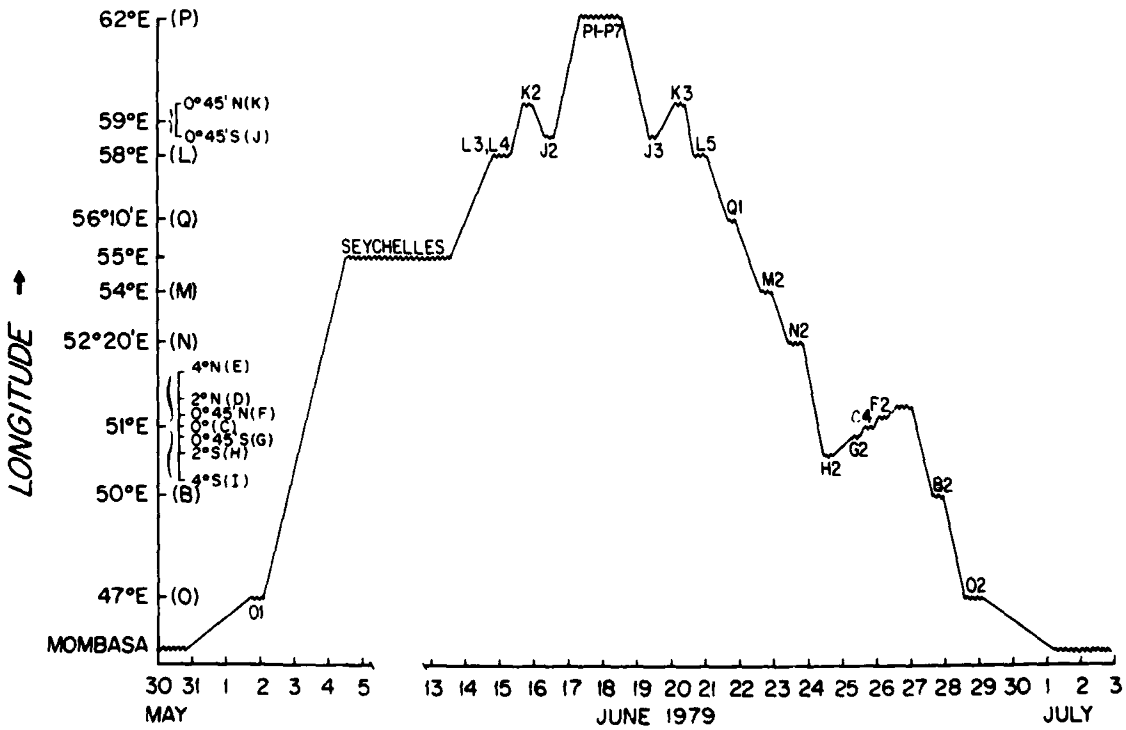


Figure 1

INSTRUMENTATION

Current Meters

The current meters described in this report were Vector Averaging Current Meters (VACMs), built by AMF SeaLink Systems (now EG&G SeaLink Systems), or Model 850 current meters built by Geodyne, now a part of Egerton, Germeshausen and Grier (EG&G).

Each time a pair of rotor magnets passes the sensing diode, the VACM samples compass and vane information and computes a measure of east and north water current components. These components are summed through the entire recording interval, usually 15 minutes, thus giving a true vector average. One complete rotor revolution initiates 8 compute cycles. Temperature is derived from a voltage-to-frequency converter (v/f), whose output frequency is related to the thermistor resistance at its input. The v/f output pulses are summed over the entire recording interval, thus averaging temperature. The thermistors are routinely calibrated before and after deployment and the temperatures are accurate to $\pm.01^{\circ}C$ (Payne et al., 1976). All variables are recorded on a cassette tape at the end of each recording interval.

The Model 850 current meter stores burst sampled data on magnetic tape cartridges. The instrument collects and stores 23 or 24 data cycles sampled at 5.27 second intervals. It then turns off for the remainder of the recording interval (usually 15 or 30 minutes). Model 850's which are modified to include temperature measurements accumulate the count from the temperature circuit from one 5.19 second period and store it at the beginning of each data burst.

Time was measured using a quartz crystal oscillator with a manufacturer's specified accuracy of ±1 second per day. All stated times are in UTC (Universal Coordinated Time). The instrument clock times were synchronized with UTC before mooring launch. After recovery, differences in the two times were noted.

The VACMs at 200 meters contained a pressure transducer, manufactured by Paine Instruments. It is a strain gauge with a rated accuracy of .05% of full scale. The instrument is routinely calibrated before deployment.

Dropsonde

The White Horse is a freely falling, acoustically self-positioning dropsonde used to determine vertical profiles of horizontal ocean currents (Luyten, Needell and Thomson, 1982).

The position of the dropsonde, relative to three bottom mounted transponders, is determined every twenty seconds. The rise and fall rates are approximately one meter per second, so the positions are determined at roughly twenty meter intervals. These data are interpolated onto a twenty-five meter grid and velocities are computed from successive grid points. Plots of the east and north velocity components are shown in the microfiche.

A second instrument, the Black Horse, is operationally identical to the White Horse, although it is configured in a slightly different manner.

For details on the design, performance and evaluation of the White/Black Horse system see Luyten et al., 1982.

CTD

CTDs manufactured by Neil Brown Instrument Systems (Brown, 1975) are mounted in both the White Horse and Black Horse. Vertical profiles of temperature and salinity were obtained with both instruments. The CTD data were recorded once per second and the instruments were ballasted to sink at approximately one meter per second. Only the down traces were used to avoid contamination by the instrument wake. The data were interpolated onto a two decibar grid.

Hydrographic stations were occupied during the dropsonde profiles to allow calibration of the CTD conductivity sensor.

Plots of potential temperature and salinity versus pressure and potential temperature versus salinity are shown in the microfiche.

Inverted Echo Sounder

The inverted echo sounder measures the time for an acoustic pulse to travel from the instrument to the sea-surface and return. Variations in the travel time are related to variations in the thermal structure and are correlated with changing thermocline depth (Watts and Rossby, 1977). The instrument was located at a depth of 5084 meters (14 meters off the bottom). A burst of 32 travel times are recorded for each one hour recording interval. They are edited by an automatic process which rejects points greater than three standard deviations from the mean. Three variables are stored; the mean of the burst, the minimum value in the burst and a modal quantity based on moments of the Rayleigh distribution. For plotting, the values are further median-smoothed (the median of the point and its two neighbors are used). Plots are shown for all three variables over two three-week periods. A plot of the 24-hour gaussian filtered mean travel-time is shown for the duration of the series. The one-hour sampled median-smoothed mean travel time for the duration of the series is shown on microfiche.

MOORINGS

Details of mooring configuration are shown in Table 2. Mooring items are listed together with depths of the instruments and lengths in meters of the other line items. Depths are underlined, and lengths of items are not underlined.

The anchors, unless otherwise stated, are 3000 pound wet weight cylinders.

The item "17" balls and chain" refers to glass flotation spheres of 17" diameter with hard hats, each one bolted to 3/8" chain at 1 meter intervals.

Figure 2 shows mooring locations and Tables 1,2 and 3 give summaries of the instruments, their depths and the quality of the data. Figure 3 shows the depths of the instruments on the moorings and water depths.

See Heinmiller (1976) for a more complete description of WHOI moorings.

DATA PROCESSING

Current Meter

The data from the instrument tapes were transcribed to 9-track magnetic tapes, converted to scientific units, edited to remove launch and retrieval transients and bad points, and linearly interpolated across missing or erroneous data cycles.

WHOI data are identified by a mooring number, a sequential instrument position number (e.g., 6553 is the third instrument down on mooring 655), a letter to indicate the data version (e.g., 6553A is the first editing of 6553), and a number to indicate the time sampling interval for that data record (e.g., 6553A900 is the fifteen minute (900 seconds) averaged version).

Low passed versions of data series were formed by passing the data through a Gaussian filter with a 24 hour half-width, and then subsampling the filtered series once a day. The composite plots shown for each WHOI mooring use these filtered data series.

Dropsonde

Processing of the White/Black Horse data consists of:

1. Transferring raw data from Sea-Data cassettes to floppy diskettes on an LSI-11 computer.
2. Decoding data and separating into acoustic and CTD data files.
3. Editing CTD data and computing sound velocity profiles.
4. Editing travel time data and converting to slant ranges.
5. Computing positions relative to transponder net and rotating to true coordinates.
6. Interpolating positions to 25 meter grid in vertical.
7. Computing and displaying the velocity profile.

The transponder coordinates are determined by a near surface survey with a towed hydrophone. The coordinates are determined by a least squares fit to the survey data (Hunt et al., 1974, Luyten et al.,1982).

The true orientation of the transponder net is determined by a least squares fit to the rotation matrix and surface current which best reconcile several ship tracks, as steered with those observed relative to the net.

A summary of the beacon locations and net orientations is presented in table 6. Table 5 contains a summary of the data quality for each profile. The profiles are identified by the net and a chronological increment (eg. B02 is the second profile at net B).

In table 5, the data quality note indicating the "4 millisecond problem" (4ms) means that data in one or more channels was lost. If two or more signals arrive at the receiver within four milliseconds of each other, then only one is actually recorded and any others are lost.

Depth

The depths of the current meters are computed in the standard way, ie. 1) The depth of the water at the anticipated anchor location is read from the Depth recorder at sea, prior to launch. 2) Adjustments are made to the wire lengths, if necessary. 3) Lengths of all mooring components are input to program NOYFB (Moller, 1976), which calculates all instrument depths.

In the experiment, the release on a mooring was used as the first beacon of the White Horse net. The net triangulation computations give the depth of the beacon. When this depth is added to the length of the wire attached to the anchor, the result is an independent measure of the water depth.

The two water depths are shown for most of the moorings in table 4.

At mooring 655, where net A was aborted, and where net O was reset later, the mooring release was not used as a beacon. At mooring 658, the on-board depth record was not available. The release was used as beacon 2 of net C, so all depths are based on the beacon depth.

Computed depths and a depth based on the most frequent pressure are also given in Table 4 for the instruments at 200m (nominal). The depth is computed from the pressure using the formula from Saunders and Fofonoff (1976).

PROGRAMS

Time Series

Current meter variables versus time are presented graphically. The composite plots (Figures 5-20) are based on daily averaged time series.

Statistics

Statistics for each variable measured by the current meters are presented on microfiche, Sheets 2 and 3, in column 10. Mean, standard error, variance, kurtosis and extrema are given for all the variables; east and north covariance, correlation and other statistics are given for the vectors. For reference, note that a Gaussian random variable would have a kurtosis of three and a skewness of zero.

See Volume XVII (POLYMODE Array II) of this series for a more detailed discussion of these parameters.

Progressive Vector and Scatter Plots

Based on a daily averaged time series, the current vectors are placed tail-to-head so as to show the path that a perfect particle in a perfectly homogeneous flow would have travelled. Flow regimes and low frequency behavior show up well on this type of plot. The plot begins with an asterisk, the first day of each month is marked with a plus sign and every six months is annotated.

Every second point from the series is plotted in a scatter plot, in which east and north components are plotted as points on a polar diagram. The line drawn through the points is the principal axis. It has slope theta (θ) (where theta is given by $\tan(2\theta) = (2\overline{uv}) / (\overline{u^2} - \overline{v^2})$) and it passes through the point $(\overline{u},\overline{v})$.

White Horse Plots

The east and north component profiles are plotted, with one point every 25 meters, for both the down and up traces.

The CTD data are plotted with one point every 2 decibars. The potential temperature and salinity are plotted versus pressure and the potential temperature is plotted versus salinity.

Vector Stick Plots

The 24-hour averaged current components are plotted as individual vectors along a time scale. Unless otherwise indicated, the vector orientation is such that east is upwards on the page.

Spectra

The horizontal kinetic energy (HKE) and temperature are displayed as spectra. The HKE spectrum is half of the sum of the spectra of the east and north components. It has the advantage of not being tied to a particular coordinate system. These plots are shown on microfiche. A spectra of east and north components plotted separately is shown in figure 4 on page 19 of the text. Five records at 200 m. are pieced together and averaged.

The HKE and temperature have units of $(cm^2/sec^2)/cph$ and $(^\circ C)^2/cph$ respectively. The spectra are all one-sided, i.e., the area under the spectrum is equal to the variance of the original record. The plots are log-log rather than 'variance preserving', i.e., the contributions of various frequency bands to the total variance are not in proportion to the displayed areas.

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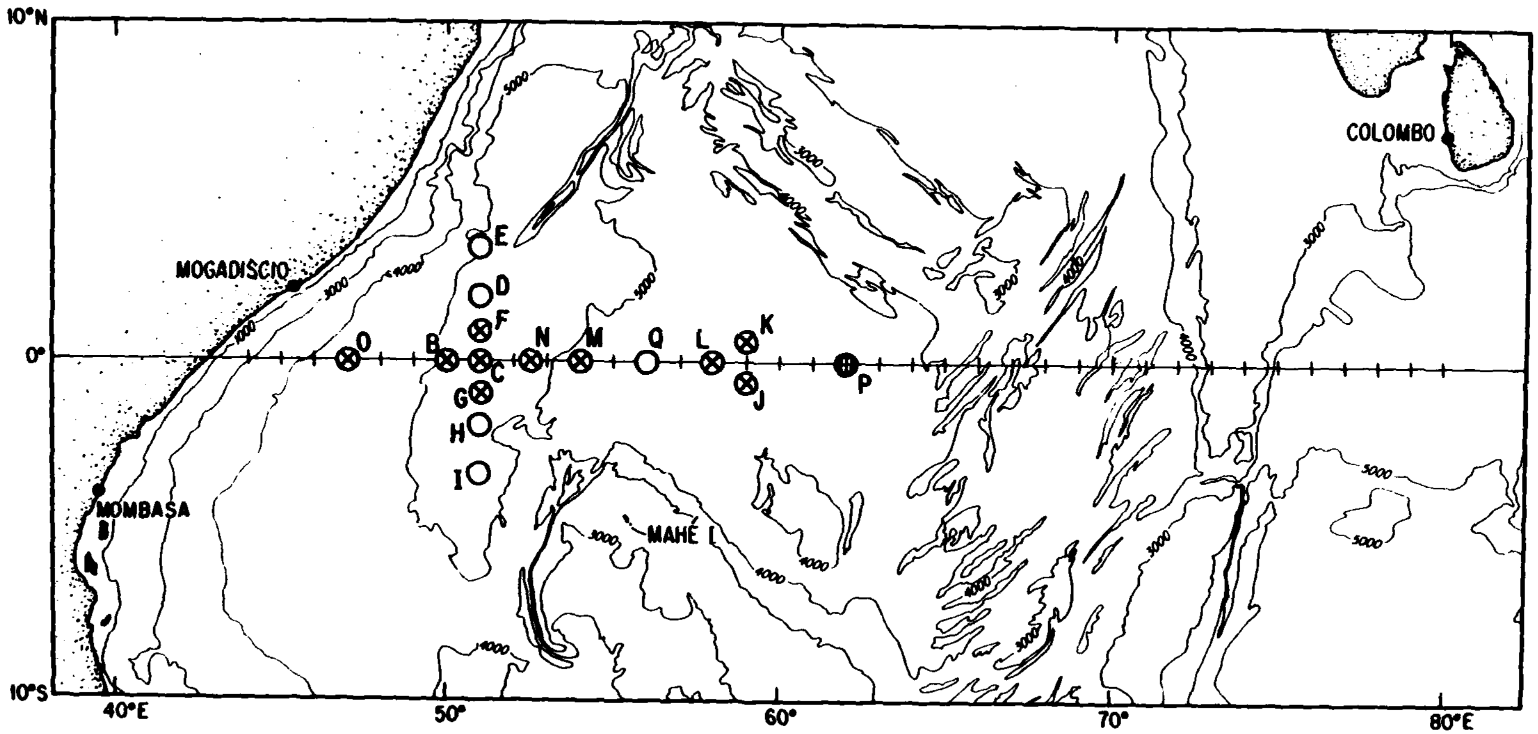
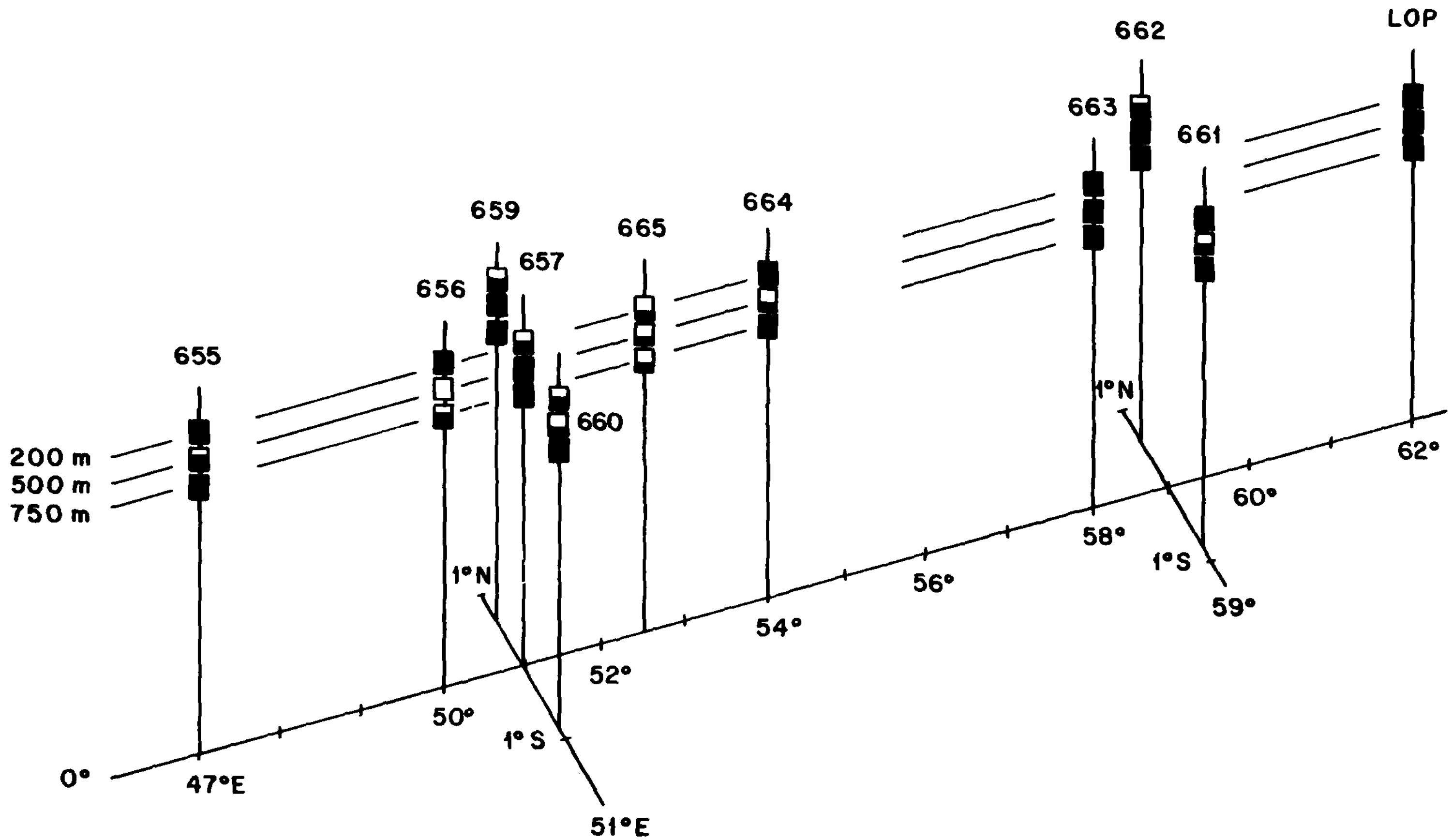


INDEX - 79 EXPERIMENT

- ○ WHITE HORSE PROFILING SITE
- × WHOI MOORING - CURRENT METERS AT 200, 500, 750 METERS
- ▯ FRENCH MOORING - CURRENT METERS AT 200, 300, 500, 750 METERS

Figure 2



INDEX 79 EQUATORIAL MOORINGS

Figure 3

TABLE 1

SUMMARY OF MOORINGS

RECORD #	DEPTH (M)	DATE SET (79)	DATE RET. (80)	LOCATION	NET	BOTTOM DEPTH (M)
6551	201	30–III	19–V	00° 4.9'N 46°54.1'E	–	4319
6552	501					
6553	751					
6561	200	31–III	17–V	00°00.0'N 50°00.0'E	B	5065
6562	500					
6563	750					
6571	205	01–IV	16–V	00°00.0'N 51°00.0'E	C	5096*
6572	505					
6573	755					
6581	5084	01–IV	16–V	00°00.0'N 51°02.0'E	E	5098
6591	206	05–IV	17–V	00°45.0'N 51°00.0'E	F	5100
6592	506					
6593	756					
6601	195	06–IV	16–V	00°45.0'S 51°02.0'E	G	5082
6602	495					
6603	745					
6611	198	13–IV	11–V	00°47.0'S 59°06.0'E	J	4604
6612	498					
6613	748					
6621	277	15–IV	12–V	00°43.0'N 59°00.0'E	K	4737
6622	577					
6623	827					
6631	199	16–IV	12–V	00°02.1'S 57°59.4'E	L	4730
6632	499					
6633	749					
MNHN249	155	10–V	09–V	00°00.3'S 61°55.9'E	P	*4658
MNHN287	455					
MNHN317	705					

*....NOTE: See table

TABLE 1 (continued)

SUMMARY OF MOORINGS

RECORD #	DEPTH (M)	DATE SET (79)	DATE RET. (80)	LOCATION	NET	BOTTOM DEPTH(M)
6641	189	18-IV	14-V	00°00.6'S	M	4924
6642	489			54°00.6'E		
6643	739					
6651	188	19-IV	15-V	00°00.3'S	N	4994
6652	488			52°27.8'E		
6653	738					

TABLE 2

DEPTHS AND LENGTHS OF MOORING ITEMS

LINE #	MOORING COMPONENT	MOORINGS 655	656	657	659	660
01	Radio float	136		140	140	130
02	Radio					
03	Light					
04	3/8" chain	2	2	2	2	2
05	3/16" wire	10	10	10	10	10
06	16" balls and chain	10	10	10	10	10
07	17" balls and chain	20	20	20	20	20
08	3/16" wire	20	20	20	20	19
09	VACM w/p	201	200	205	206	195
10	3/16" wire	265	265	265	265	265
11	17" balls and chain	11	11	11	11	11
12	3/16" wire	20	20	20	20	20
13	850 CM	501	500	505	506	495
14	3/16" wire	243	243	243	243	243
15	17" balls and chain	3	3	3	3	3
16	VACM	751	750	755	756	745
17	3/16" wire	1000	1000	1000	1000	1000
18	17" balls and chain	4	4	4	4	4
19	3/16" wire	1000	1000	1000	1000	1000
20	17" balls and chain	3	3	3	3	3
21	3/16" wire	1000	1000	1000	1000	1000
22	17" balls and chain	3	3	3	3	3
23	3/16" wire	400	800	800	1000	800
24	3/16" wire	20	20	200	50	50
25	3/16" wire	50	200	200	200	200
26	3/16" wire	20	200	20	20	200
27	5/8" nylon	9	20	4		11
28	17" balls and chain	10	12	12	12	12
29	Release	2	2	2	2	2
30	1/2" chain	3	3	3	3	3
31	3/4" nylon	10	10	10	10	10
32	1/2" chain	5	5	5	5	5
33	Anchor	4319	5065	5054	5100	5082

TABLE 2 (continued)

DEPTHS AND LENGTHS OF MOORING ITEMS

LINE #	MOORING COMPONENT	MOORINGS 661	662	663	664	665
01	Radio float	133	212	144	124	123
02	Radio					
03	Light					
04	3/8" chain	2	2	2	2	2
05	3/16" wire	10	10		10	10
06	16" balls and chain	10	10	10	10	10
07	17" balls and chain	20	20	20	20	20
08	3/16" wire	20	20	20	20	20
09	VACM w/P	198	277	199	189	188
10	3/16" wire	265	265	265	265	265
11	17" balls and chain	11	11	11	11	11
12	3/16" wire	20	20	20	20	20
13	850 CM	498	577	499	489	488
14	3/16" wire	243	243	243	243	243
15	17" balls and chain	3	3	3	3	3
16	VACM	748	827	749	739	738
17	3/16" wire	1000	1000	1000	1000	1000
18	17" balls and chain	4	4	4	4	4
19	3/16" wire	1000	1000	1000	1000	1000
20	17" balls and chain	3	3	3	3	3
21	3/16" wire	724	1000	724	1000	1000
22	Aandaraa	1		1		
23	3/16" wire	20		276		
24	T/P	1				
25	3/16" wire	256				
26	17" balls and chain	3	3	3	3	3
27	3/16" wire	500	98	500	800	800
28	3/16" wire	200	385	200	100	
29	3/4" nylon					10
30	3/16" wire	50	98		200	50
31	3/16" wire	20	50			100
32	3/4" nylon		10		10	
33	3/16" wire		98			20
34	3/16" wire		98			200
35	5/8" nylon	11		7		
36	3/16" wire			100		
37	3/16" wire			100		
38	17" balls and chain	12	11	11	12	12
39	Release	2	2	2	2	2
40	1/2" chain	3	3	3	3	3
41	3/4" nylon	10	10	10	10	10
42	1/2" chain	5	5	5	5	5
43	Anchor	4604	4737	4730	4924	4994

TABLE 3

DATA RETURN AND QUALITY

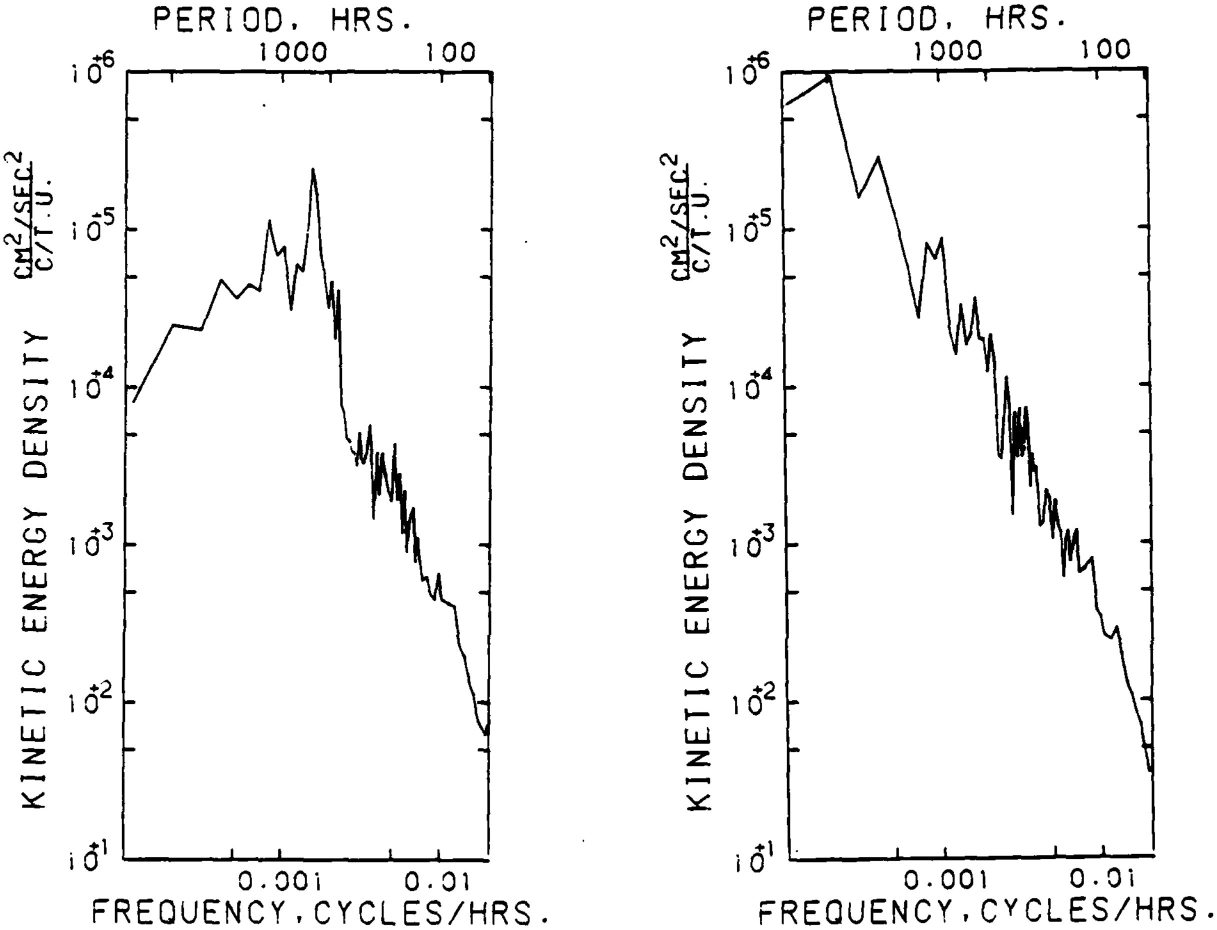
DATA RECORD	DATA DATES		COMMENTS
6551	79-III-31	80- V-09	
6552	79-III-31	80- III-21	No speed 21 Mar. through 20 Apr.
6553	79-III-31	80- V-18	
6561	79-IV-01	80- V-16	Pressure no good after Feb.
6562			Data no good
6563	79-IV-01	79- XI-24	No data after 24 Nov.
6571	79-IV-02	79-VIII-23	no usable speed after 24 Aug. Instrument dies 26 Dec.
6572	79-IV-02	80- III-25	No speed after 25 Mar.
6573	79-IV-02	80- V-15	
6591	79-IV-06	79- V-26	Vane bad after 26 May
6592	79-IV-06	80- V-16	
6593	79-IV-06	80- V-16	
6601	79-IV-07	79- XII-30	Speed quits 01 Jan. 1980
6602	79-IV-07	79- VI-06	Only two months of data
6603	79-IV-07	80- V-15	
6611	79-IV-14	80- V-09	
6612	79-IV-14	80- V-10	Speed, temperature only; vane a problem
6613	79-IV-14	80- V-10	
6621	79-IV-16	80- II-21	
6622	79-IV-16	80- V-11	
6623	79-IV-16	80- V-11	
6631	79-IV-17	80- V-10	Temperature may be off as much as .3°C.
6632	79-IV-17	80- V-11	
6633	79-IV-17	80- V-11	
6641	79-IV-19	80- V-13	
6642	79-IV-19	79- V-28	Time is off by five days
6643	79-IV-18	80- V-13	
6651	79-IV-19	79- VI-20	
6652	79-IV-19	80- V-14	Vane loses all lower half values after 24 July. Temperature and rotor problems.
6653	79-IV-19	79- V-26	

TABLE 4

Bottom Depth and 200 m. Depth Comparisons.

Mooring #	Bottom Depth (m) (from PGR)	Bottom Depth (m) (from net triangulation)	Difference (m)	Depth 200m	Most Freq. Pres. dbars	Equivalent depth (m)
655	4319	4410	*	201	225	224
656	5065	5073	8	195	235	234
657	5054	5096	42	205	280	278
658	-	5098	-			
659	5100	5099	-1	206	230	229
660	5082	5097	15	195	227	226
661	4604	4606	2	198	225	224
662	4737	4734	-3	227	295	293
663	4730	4731	1	199	220	219
664	4924	4931	7	189	225	224
665	4994	4998	4	188	220	219

*NOTE: See text



AUTO SPECTRUM
179200MZ5TM N.COMP SMERG
195 METERS
79-IV-10 TO 84-IX-29
5 PIECES WITH 200 ESTIMATES
PER PIECE, AVERAGED OVER
1 ADJACENT FREQUENCY BANDS

AUTO SPECTRUM
179200MZ5TM E.COMP SMERG
195 METERS
79-IV-10 TO 84-IX-29
5 PIECES WITH 200 ESTIMATES
PER PIECE. AVERAGED OVER
1 ADJACENT FREQUENCY BANDS

Figure 4

TABLE 5

WHITE HORSE DATA QUALITY

DROP	DATE 1979	HOUR	CODE	COMMENTS
A	Aborted			
B01	March 31	2307	*	
B02	June 27	1738	*	
C01	April 02	0102	*	
C02	April 06	0307	C	No CTD data from the start
C03	April 19	1731	B	Down noisy to 2750m.
C04	June 25	0437	D7	No Up-4ms problem.Beacon III out 3600-2780m.
D01	April 03	0153	*	
D02	April 04	1637	C D	CTD malfunctioned on Up at 1841m.
E01	April 04	0019	*	
F01	April 05	1527	C	CTD data bad from the start
F02	June 26	0023	*	
G01	April 06	2000	*	
G02	June 25	0437	*	
H01	April 07	1603	*	
H02	June 24	1425	N 4	Beacon II totally out
I01	April 08	1620	*	
J01	April 14	1004	U 4	Down-4ms problem:Beacon I & II out UP-Beacon III out 701-340m
J02	June 16	0656	*	
J03	June 19	0916	*	

CODE

- * Everything present and good, including CTD
- B Black Horse
- D Down used
- U Up used
- 4 4ms problem
- C CTD bad, but acoustics good
- N No good at all

TABLE 5 (continued)

WHITE HORSE DATA QUALITY (continued)

DROP	DATE 1979	HOUR	CODE	COMMENTS
K01	April 15	1421	*	
K02	June 15	1437	*	
K03	June 19	2343	D 4	Up-4ms problem:Beacon I out,Down-1128-2813m. Beacon III out,I and II very noisy
L01	April 16	1348	*	
L02	April 16	1832	* B	
L03	June 14	2125	*	
L04	June 15	0244	* B	Down 100-400m. data bad,Up-upper 100m data bad
L05	June 20	1540	*	
M01	April 18	0832	B D 4	Up-4ms problem:3200-4745m. Beacon III very noisy
M02	June 22	1600		Up-upper 200m Beacon III bad.
N01	April 19	0425	* B	
N02	June 23	1229	*	
O01	June 01	2253	*	
O02	June 28	1506	*	
P01	June 17	0858	B *	Up-upper 200m very noisy
P02	June 17	1142	*	
P03	June 17	1553	B *	Down-Beacon I intermittant noise
P04	June 17	1936	*	
P05	June 18	0017	B *	
P06	June 18	0403	*	
P07	June 18	0910	B *	
Q01	June 21	1714	U	Down very noisy

CODE

- * Everything present and good, including CTD
- B Black Horse
- D Down used
- U Up used
- 4 4ms problem
- C CTD bad, but acoustics good
- N No good at all

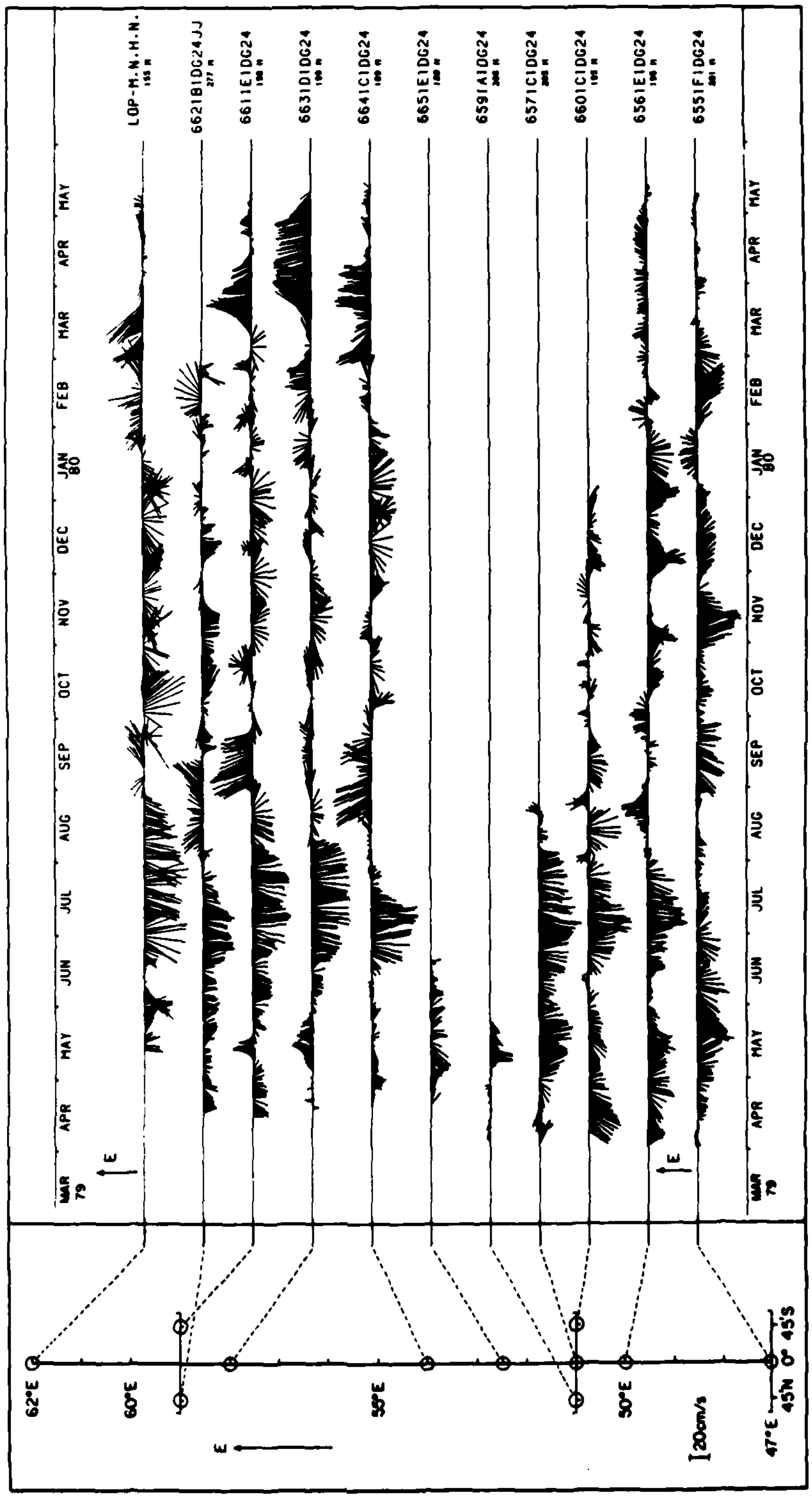
TABLE 6

WHITE HORSE NET SUMMARY

NET	LOCATION	DATE OF SURVEY 1979	NET COORDINATES beac 1:x,y,z beac 2:x,y,z beac 3:x,y,z (meters)	ORIENTATION OF NET (deg. E of N)
A	00°05'N 46°54'E	ABORTED		
B	00°03'N 50°00'E	APRIL 1	0, 0,5054 3350, 0,5056 1949,3134,5056	89
C	00°02'N 51°00'E	APRIL 1	0, 0,5077 3734, 0,5086 2140,3596,5079	80
D	02°00'N 51°03'E	APRIL 2	0, 0,5087 3719, 0,5090 1707,3106,5085	112
E	04°02'N 50°57'E	APRIL 3	0, 0,4831 3888, 0,4857 2004,3407,4853	85
F	00°48'N 51°00'E	APRIL 5	0, 0,5080 3672, 0,5083 1656,3045,5084	96
G	00°45'S 51°04'E	APRIL 6	0, 0,5078 3860, 0,5080 1782,3382,5079	97
H	01°56'S 51°11'E	APRIL 7 JUNE 24	0, 0,5079 4123, 0,5080 1996,3491,5080	81
I	03°49'S 51°01'E	APRIL 8	0, 0,5029 3961, 0,5070 1936,3271,5056	87

TABLE 6 (continued)

NET	LOCATION	DATE OF SURVEY	NET COORDINATES (meters)	ORIENTATION
J	00°45'S 59°00'E	APRIL 14	0, 0,4587 5237, 0,4546 3337,2758,4591	108
K	00°43'N 58°59'E	APRIL 15 JUNE 15	0, 0,4715 3559, 0,4722 1660,3123,4720	88
L	00°02'N 58°02'E	APRIL 16 JUNE 20	0, 0,4712 3819, 0,4709 1915,3243,4675	94
M	00°00'N 54°01'E	JUNE 22	0, 0,4912 3733, 0,4952 2026,3070,4957	91
N	00°01'S 52°29'E	JUNE 23	0, 0,4980 3581, 0,5056 1879,3003,5084	97
O	00°00'N 47°08'E	JUNE 1	0, 0,4391 3763, 0,4406 1810,3115,4390	94
P	00°01'N 62°05'E	JUNE 17	0, 0,4638 3833, 0,4564 2373,3247,4665	90
Q	00°01'N 56°12'E	JUNE 21	0, 0,4591 3722, 0,4611 1710,3208,4586	97



LOP-M.N.H.N.
6621B1DG24JJ
6611E1DG24
6631D1DG24
6641C1DG24
6651E1DG24
6591A1DG24
6571C1DG24
6601C1DG24
6561E1DG24
6551F1DG24
MAR 79
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN 80
FEB
MAR
APR
MAY
E
62°E
60°E
55°E
50°E
47°E
45'N
0°
45'S
20cm/s

Figure 5

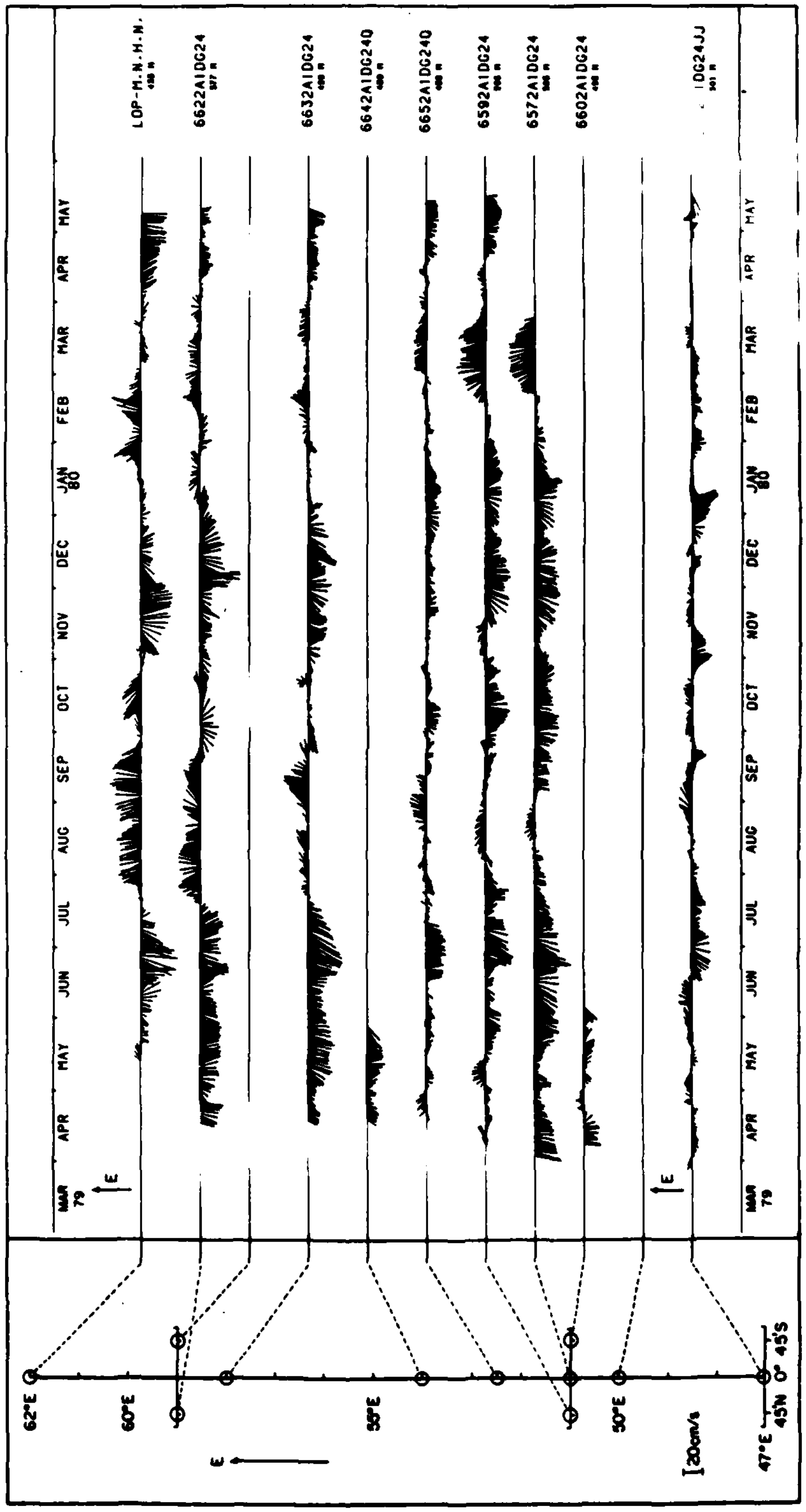
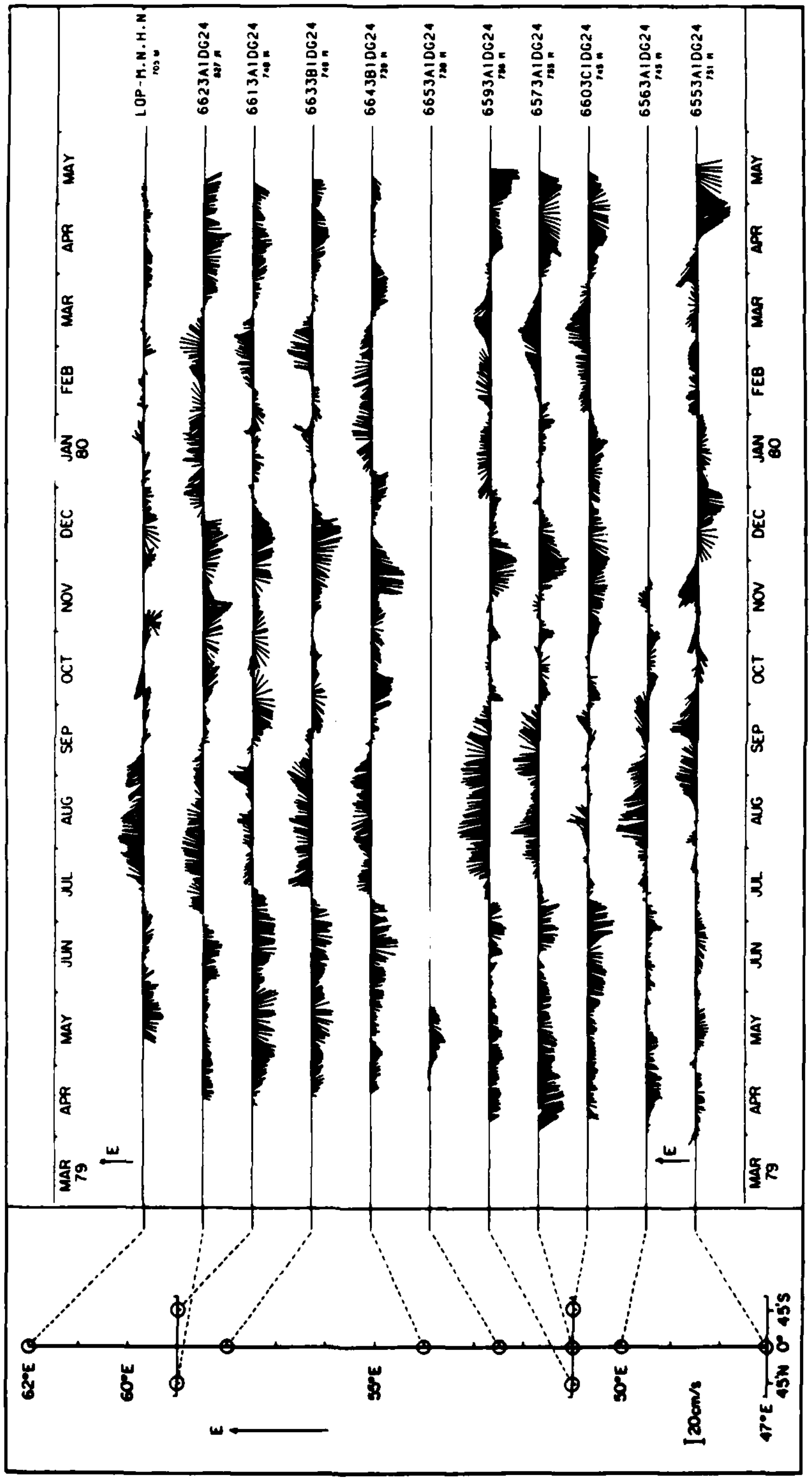

LOP-M.N.M.N.
6622A1DG24
6632A1DG24
6642A1DG24Q
6652A1DG24Q
6592A1DG24
6572A1DG24
6602A1DG24
IDG24JJ
MAR 79
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN 80
FEB
MAR
APR
MAY
E
62°E
60°E
55°E
50°E
47°E
20cm/s
45'N
0°
45'S

Figure 6



MAR 79
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN 80
FEB
MAR
APR
MAY
LOP-M.N.H.N
6623A1DG24
6613A1DG24
6633B1DG24
6643B1DG24
6653A1DG24
6593A1DG24
6573A1DG24
6603C1DG24
6563A1DG24
6553A1DG24
E
62°E
60°E
55°E
50°E
47°E
45'N
0° 45'S
20cm/s

Figure 7

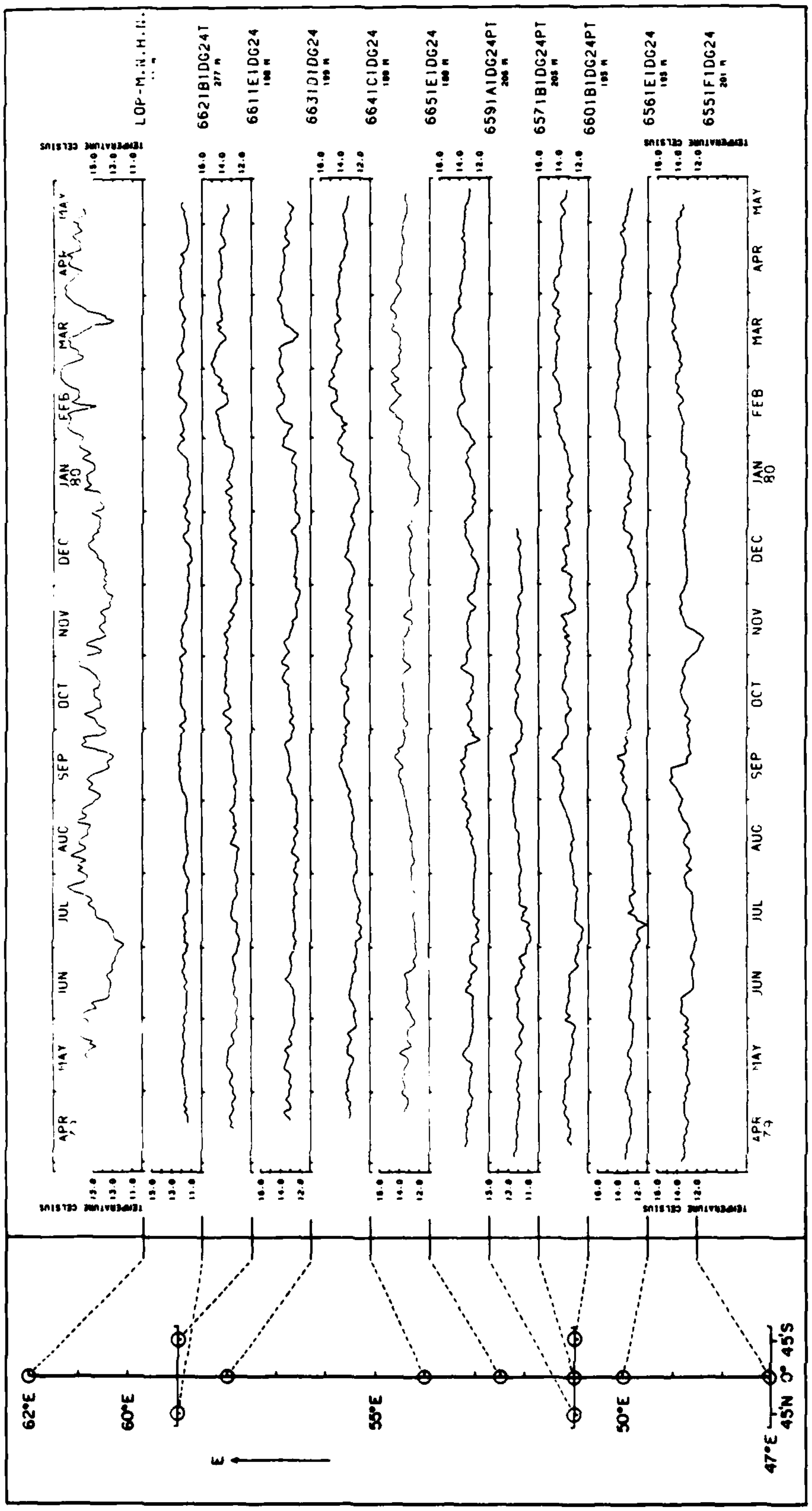

6621B1DG24T
6611E1DG24
6631D1DG24
6641C1DG24
6651E1DG24
6591A1DG24PT
6571B1DG24PT
6601B1DG24PT
6561E1DG24
6551F1DG24
TEMPERATURE CELSIUS
APR 79
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN 80
FEB
MAR
APR
MAY
62°E
60°E
55°E
50°E
47°E
45'N
0°
45'S
E

Figure 8

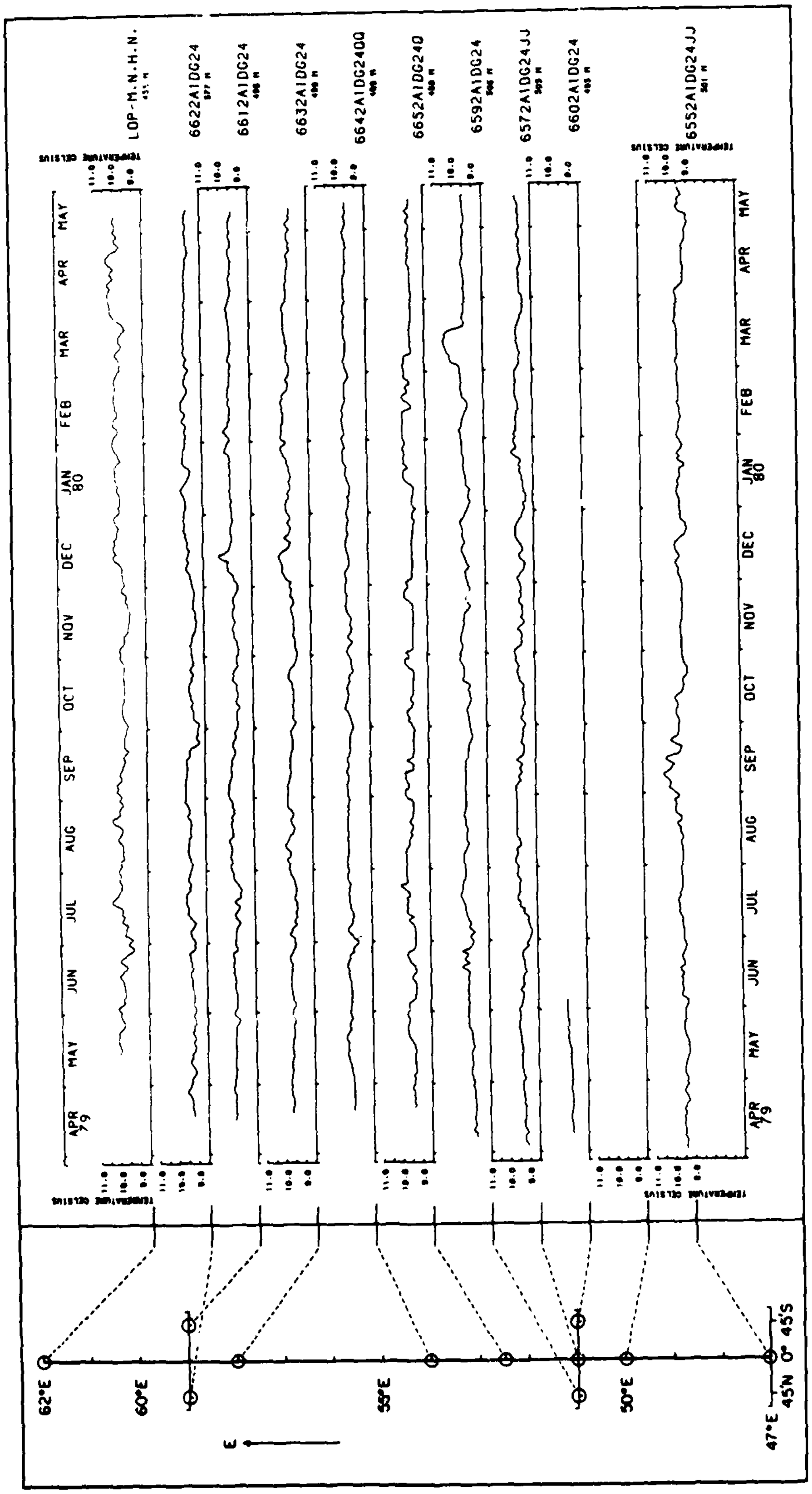

LOP-M.N.H.N.
6622A1DG24
6612A1DG24
6632A1DG24
6642A1DG24Q
6652A1DG24Q
6592A1DG24
6572A1DG24JJ
6602A1DG24
6552A1DG24JJ
TEMPERATURE CELSIUS
11.0
10.0
9.0
APR 79
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN 80
FEB
MAR
APR
MAY
62°E
60°E
55°E
50°E
47°E
45'N
0°
45'S
E

Figure 9

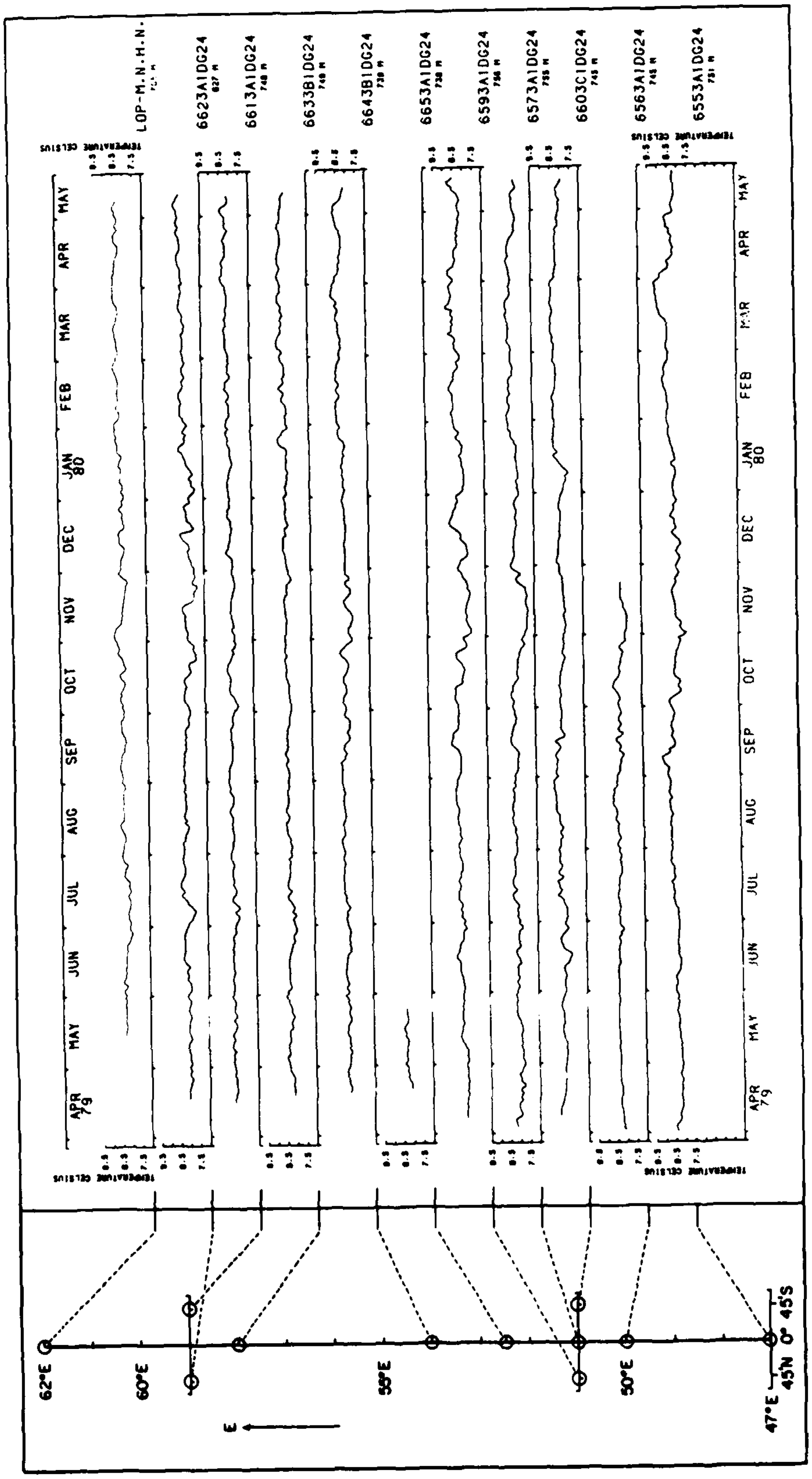

LOP-M.N.H.N.
6623A1DG24
6613A1DG24
6633B1DG24
6643B1DG24
6653A1DG24
6593A1DG24
6573A1DG24
6603C1DG24
6563A1DG24
6553A1DG24
TEMPERATURE CELSIUS
APR 79
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN 80
FEB
MAR
APR
MAY
62°E
60°E
55°E
50°E
47°E
45°N
0°
45°S
E

Figure 10

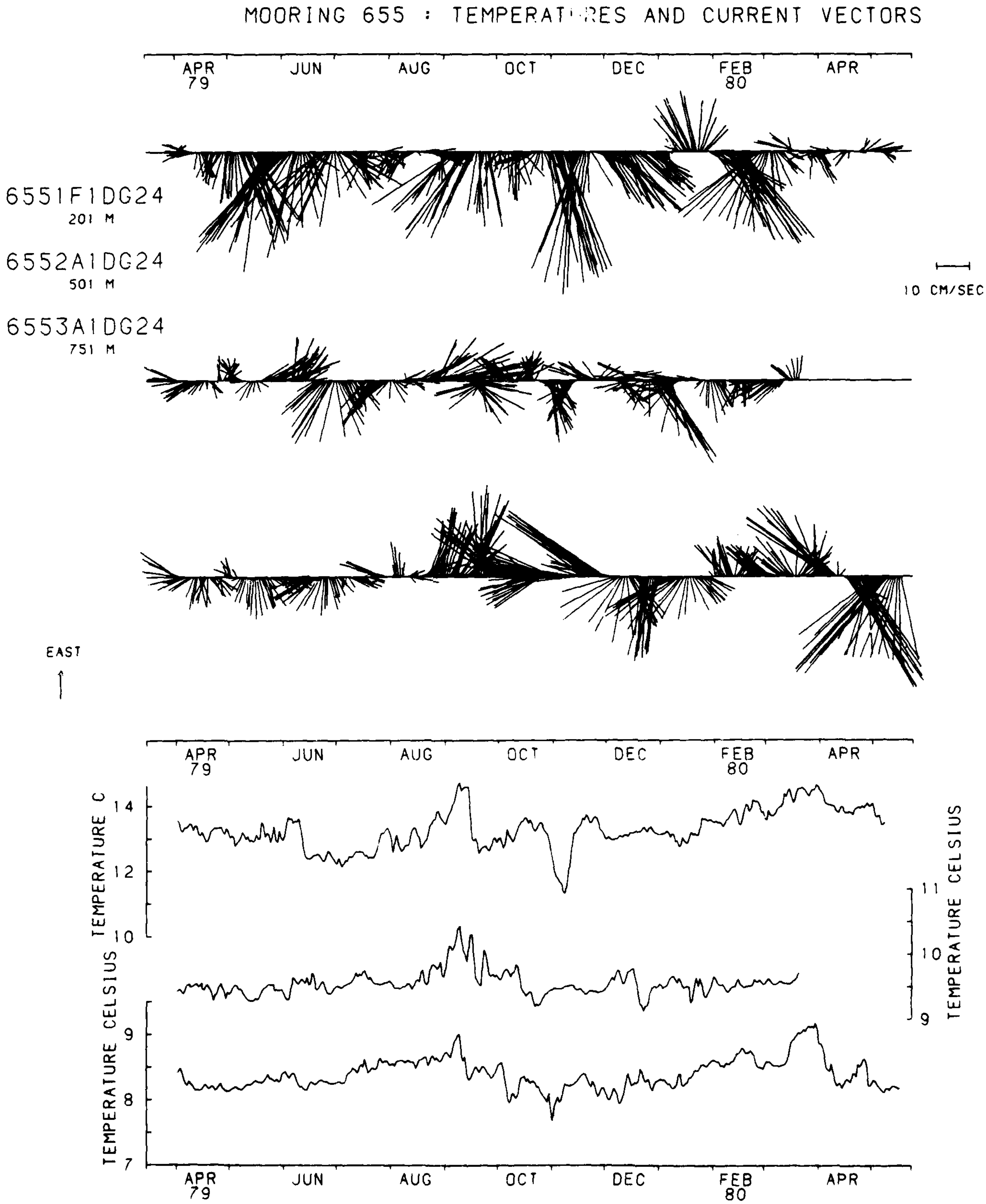
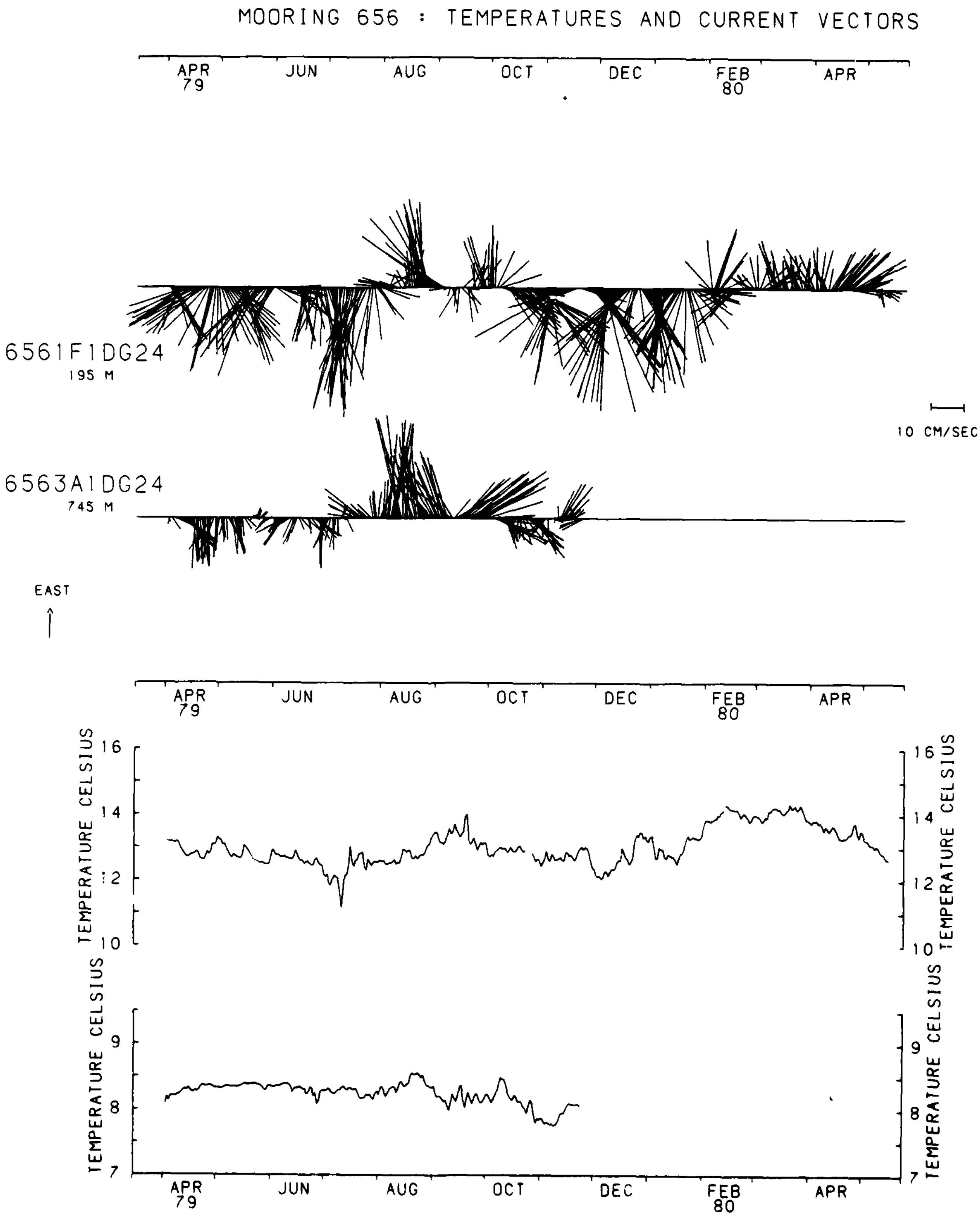

MOORING 655 : TEMPERAT RES AND CURRENT VECTORS
APR 79
JUN
AUG
OCT
DEC
FEB 80
APR
6551F1DG24
201 M
6552A1DG24
501 M
6553A1DG24
751 M
10 CM/SEC
EAST
TEMPERATURE C
TEMPERATURE CELSIUS
14
12
10
11
10
9
9
8
7

Figure 11



MOORING 656 : TEMPERATURES AND CURRENT VECTORS
APR 79
JUN
AUG
OCT
DEC
FEB 80
APR
6561F1DG24
195 M
10 CM/SEC
6563A1DG24
745 M
EAST
TEMPERATURE CELSIUS
16
14
12
10
9
8
7

Figure 12

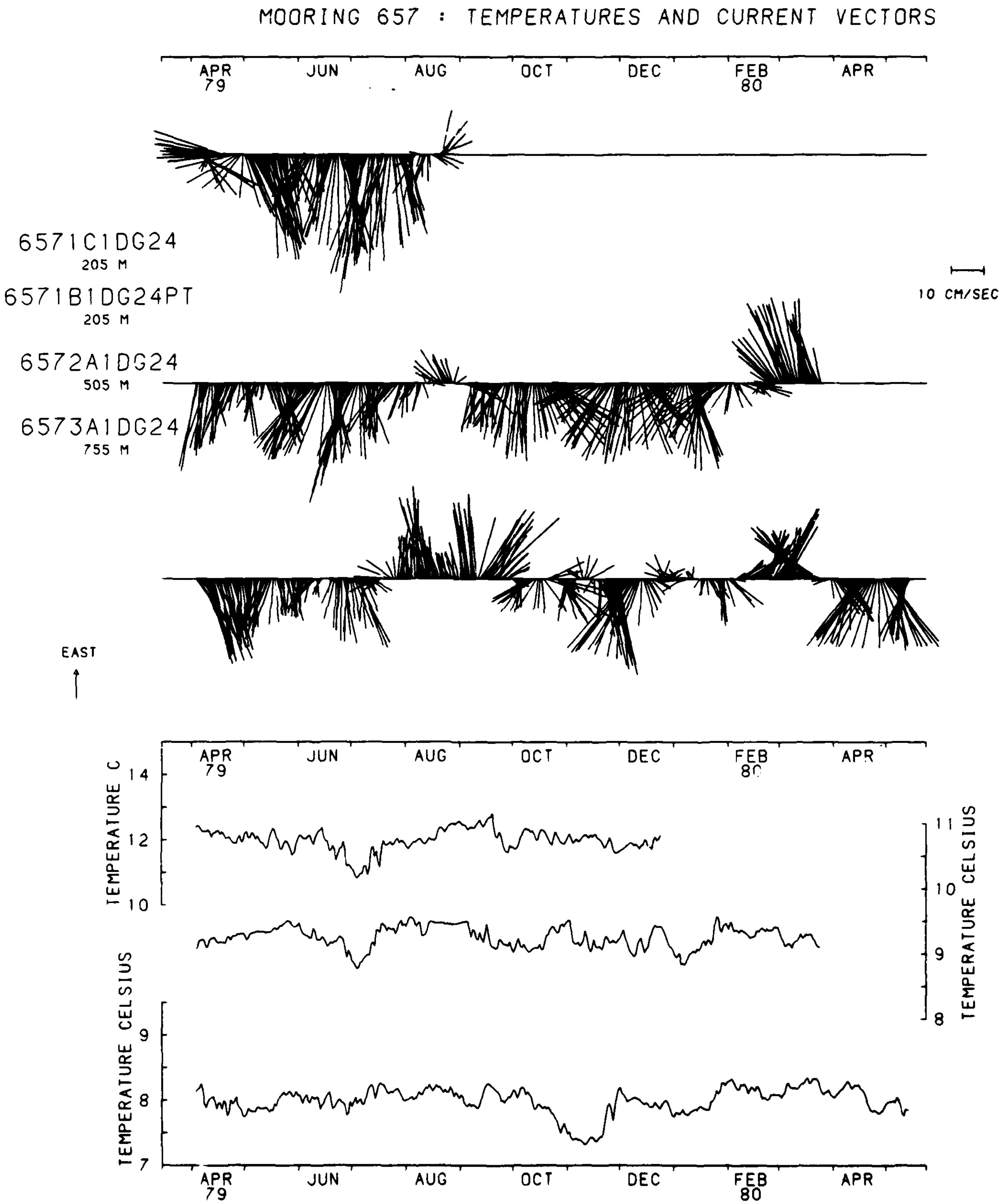
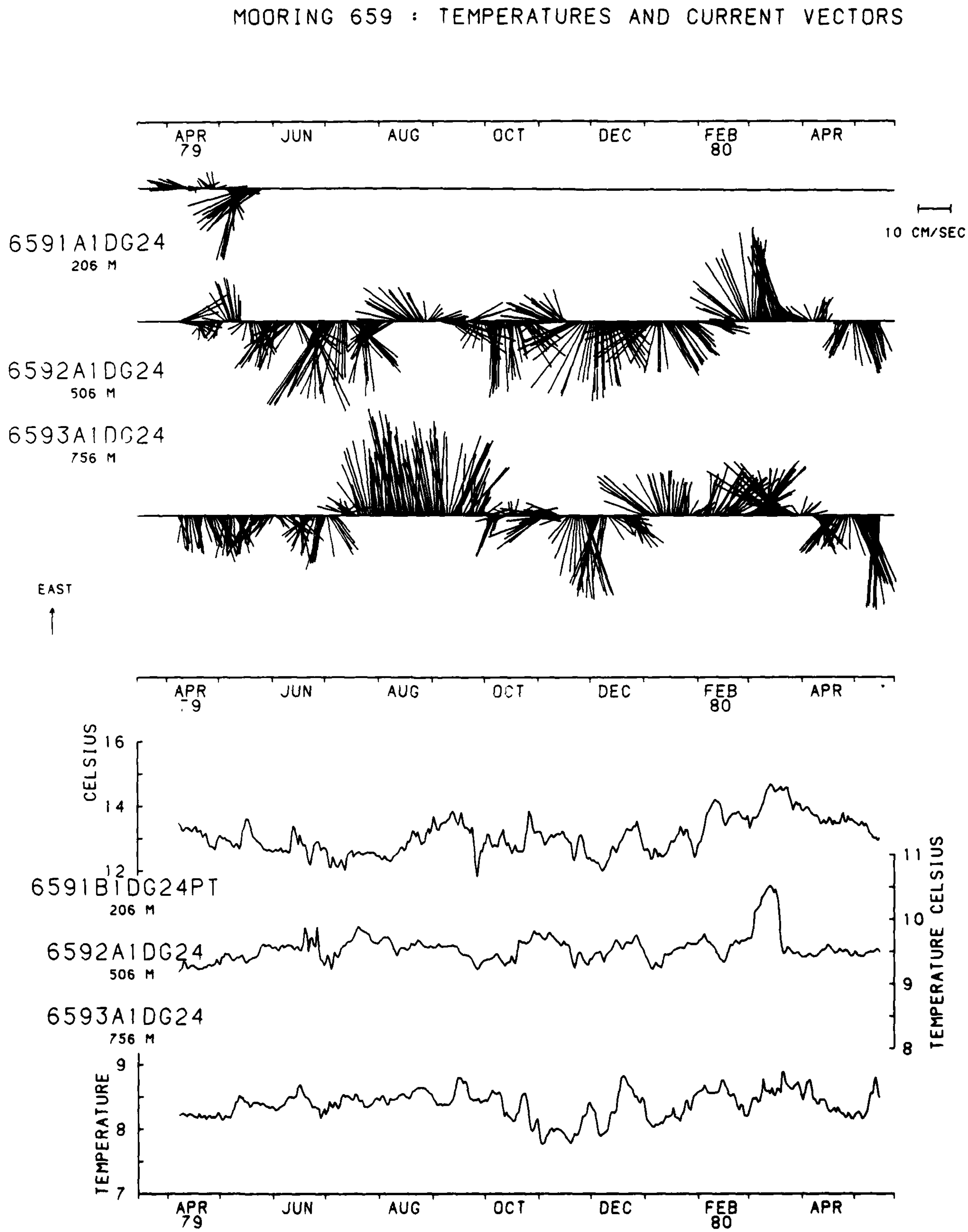

MOORING 657 : TEMPERATURES AND CURRENT VECTORS
APR 79
JUN
AUG
OCT
DEC
FEB 80
APR
6571C1DG24
205 M
6571B1DG24PT
205 M
6572A1DG24
505 M
6573A1DG24
755 M
10 CM/SEC
EAST
TEMPERATURE C
14
12
10
TEMPERATURE CELSIUS
11
10
9
8
TEMPERATURE CELSIUS
9
8
7

Figure 13



MOORING 659 : TEMPERATURES AND CURRENT VECTORS
APR 79
JUN
AUG
OCT
DEC
FEB 80
APR
10 CM/SEC
6591A1DG24
206 M
6592A1DG24
506 M
6593A1DG24
756 M
EAST
CELSIUS
16
14
12
6591B1DG24PT
206 M
6592A1DG24
506 M
6593A1DG24
756 M
11
10
9
8
TEMPERATURE CELSIUS
TEMPERATURE
9
8
7

Figure 14

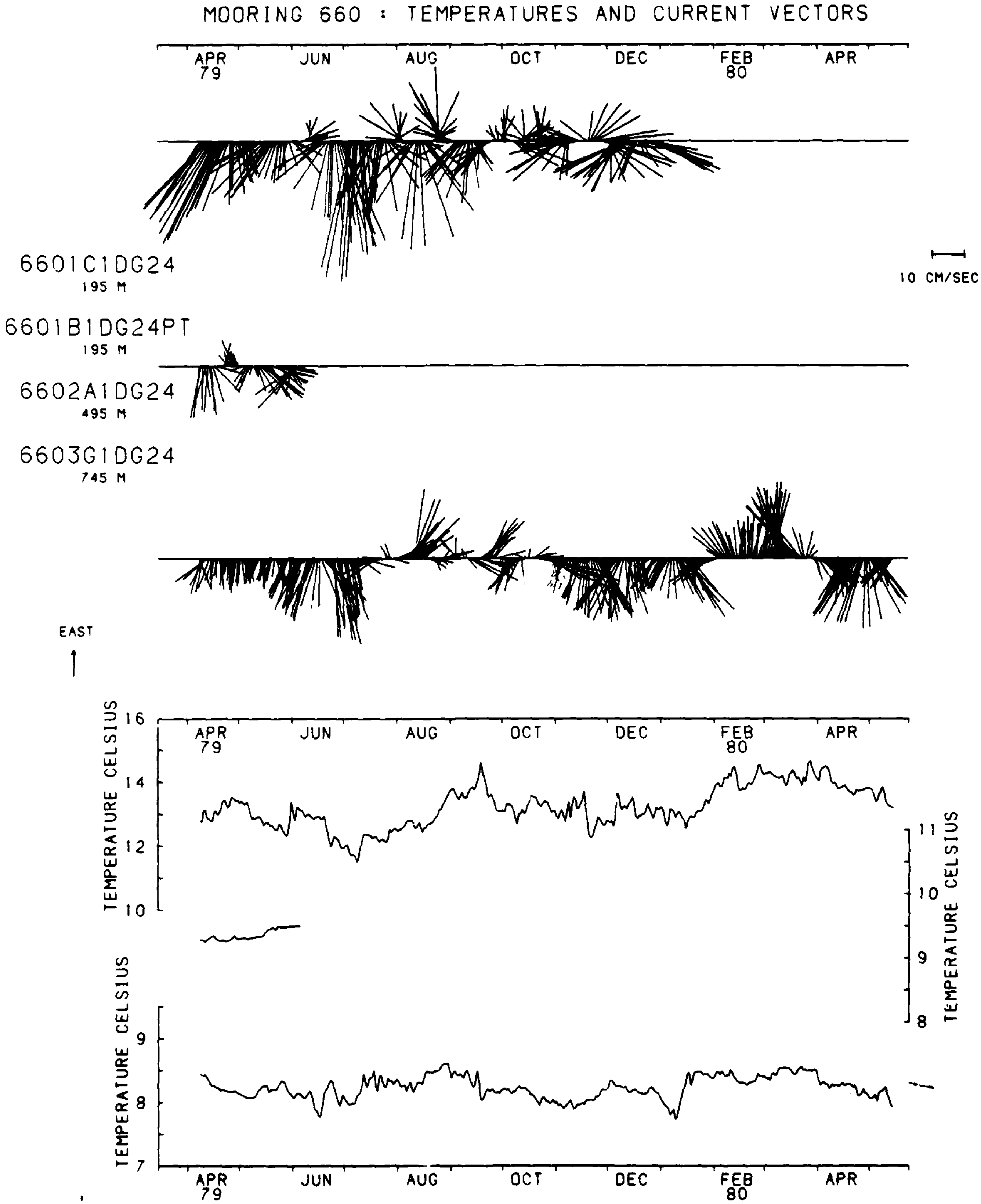

MOORING 660 : TEMPERATURES AND CURRENT VECTORS
APR 79
JUN
AUG
OCT
DEC
FEB 80
APR
6601C1DG24
195 M
6601B1DG24PT
195 M
6602A1DG24
495 M
6603G1DG24
745 M
10 CM/SEC
EAST
TEMPERATURE CELSIUS
16
14
12
10
11
10
9
8
9
8
7

Figure 15

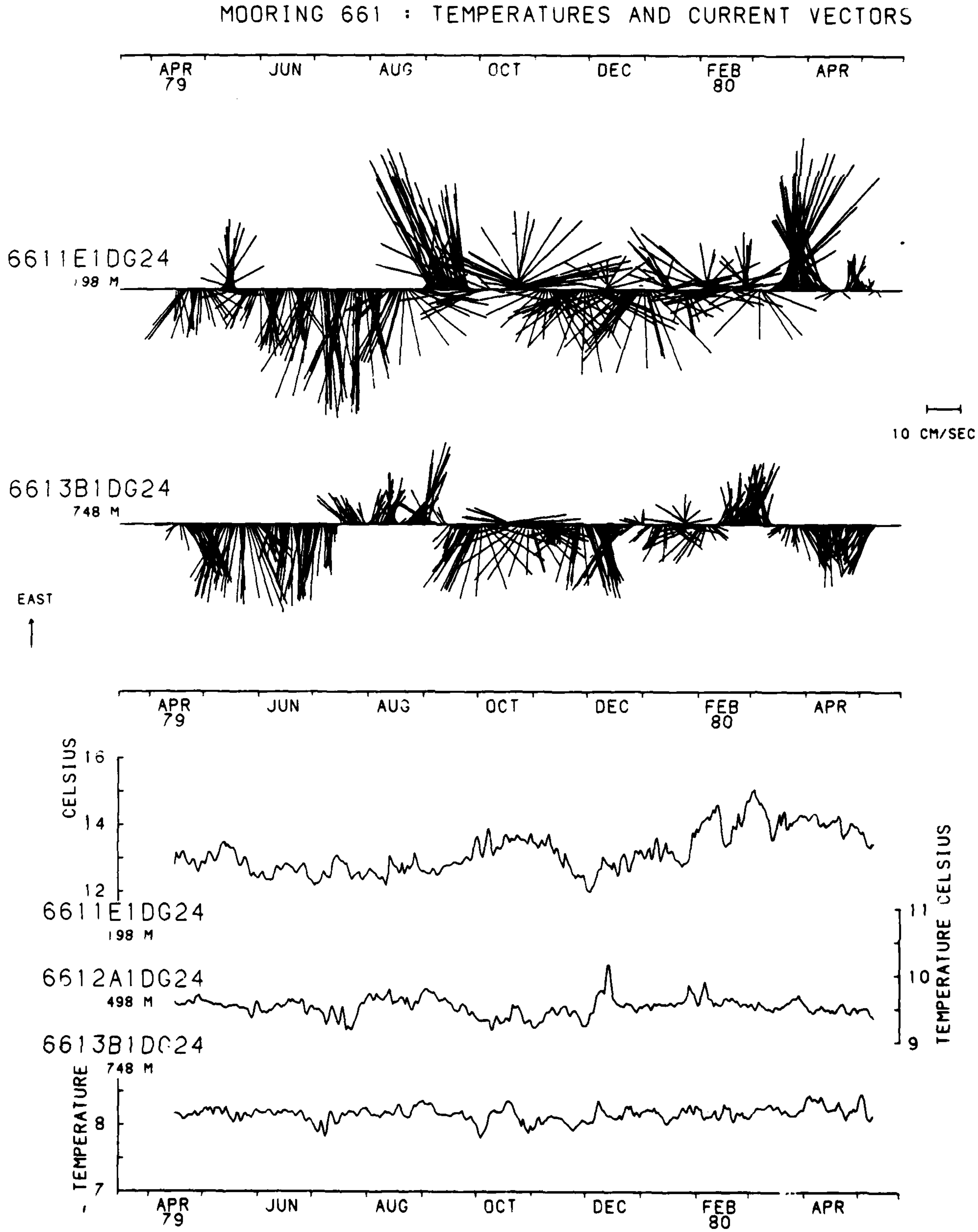

MOORING 661 : TEMPERATURES AND CURRENT VECTORS
APR 79
JUN
AUG
OCT
DEC
FEB 80
APR
6611E1DG24
198 M
10 CM/SEC
6613B1DG24
748 M
EAST
CELSIUS
16
14
12
6611E1DG24
198 M
6612A1DG24
498 M
6613B1DG24
748 M
TEMPERATURE CELSIUS
11
10
9
TEMPERATURE
8
7

Figure 16

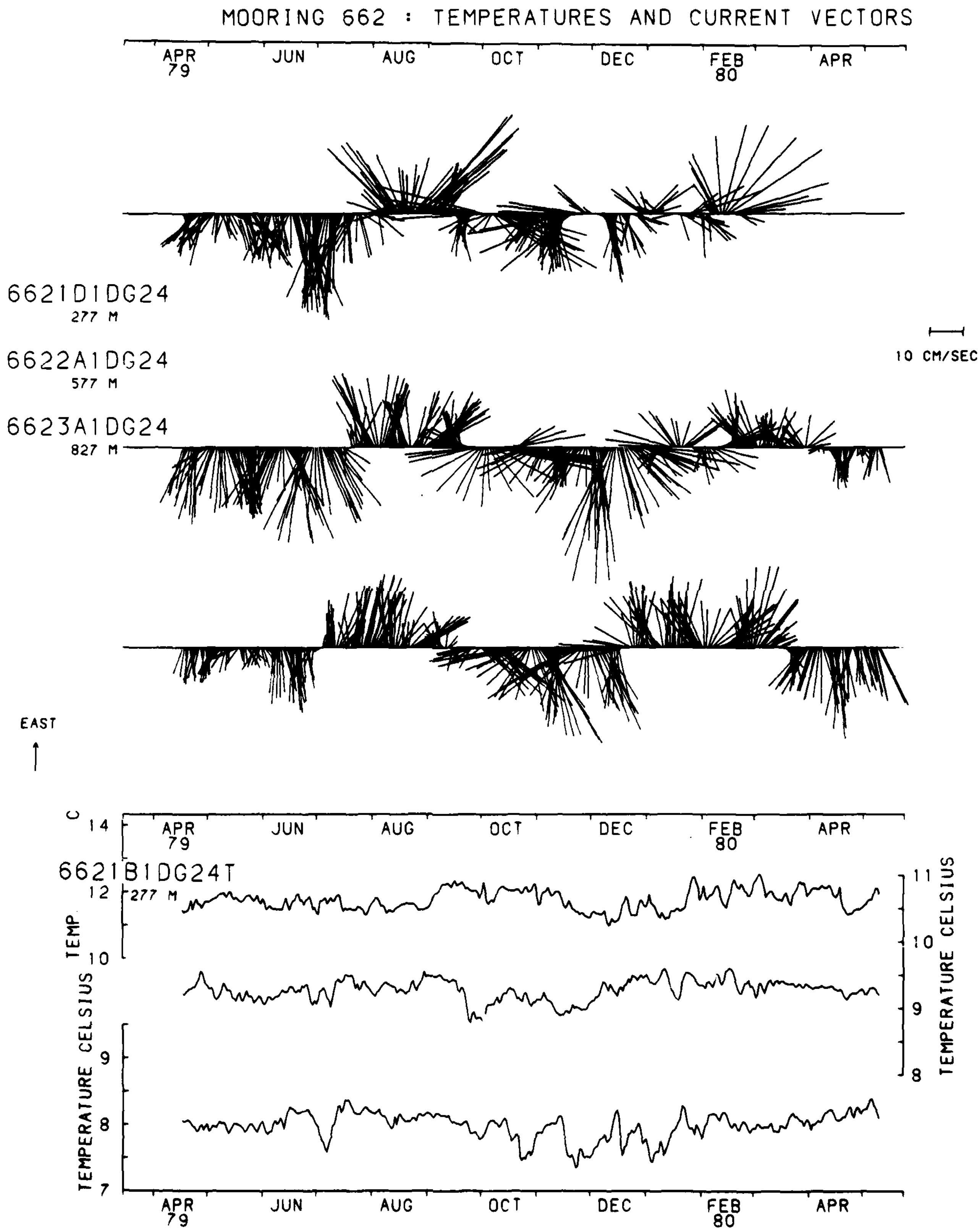
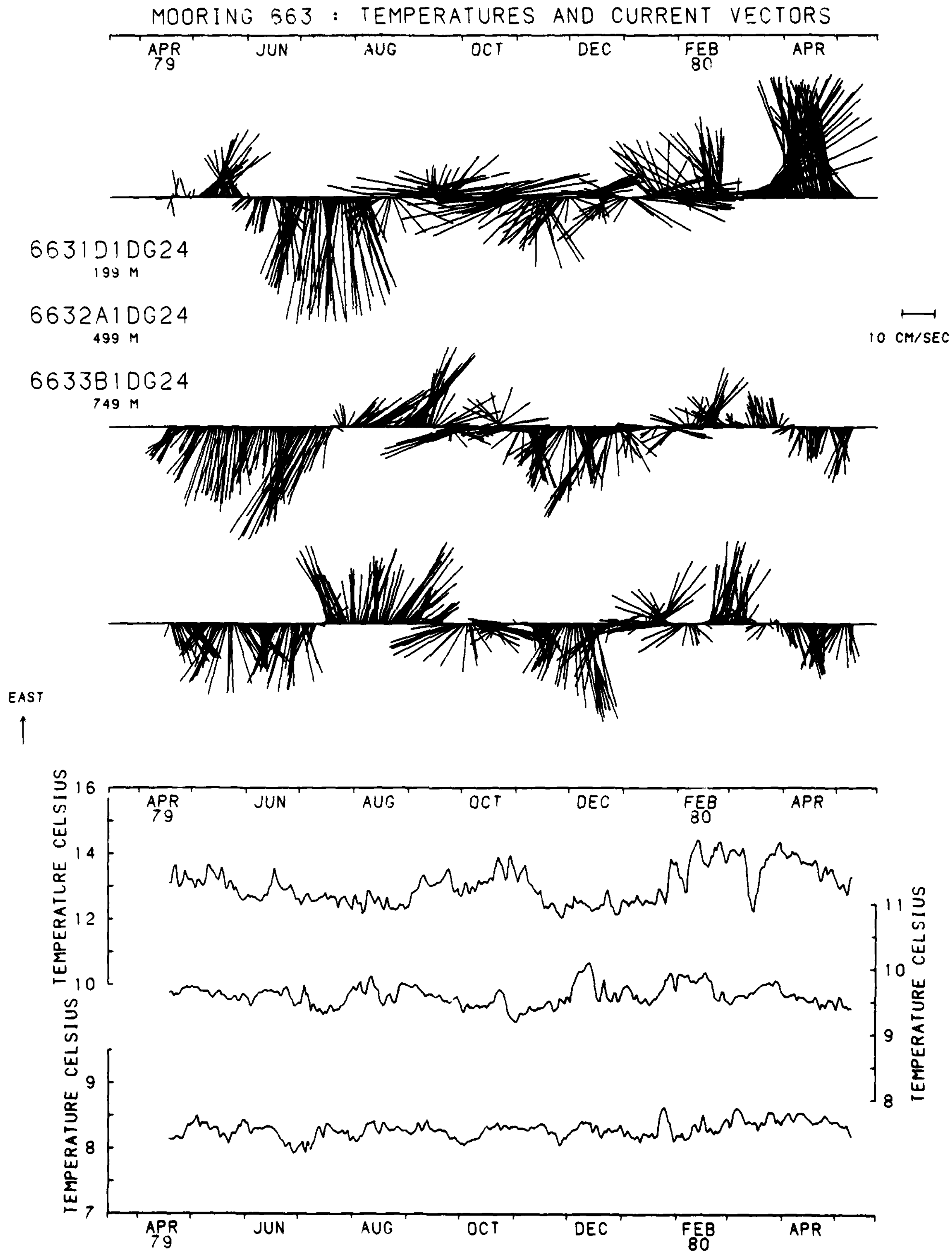

MOORING 662 : TEMPERATURES AND CURRENT VECTORS
APR 79
JUN
AUG
OCT
DEC
FEB 80
APR
6621D1DG24
277 M
6622A1DG24
577 M
6623A1DG24
827 M
10 CM/SEC
EAST
6621B1DG24T
277 M
TEMP C
TEMPERATURE CELSIUS
14
12
10
9
8
7
11
10
9
8

Figure 17



MOORING 663 : TEMPERATURES AND CURRENT VECTORS
APR 79
JUN
AUG
OCT
DEC
FEB 80
APR
6631D1DG24
199 M
6632A1DG24
499 M
6633B1DG24
749 M
10 CM/SEC
EAST
TEMPERATURE CELSIUS
16
14
12
10
11
9
8
7

Figure 18

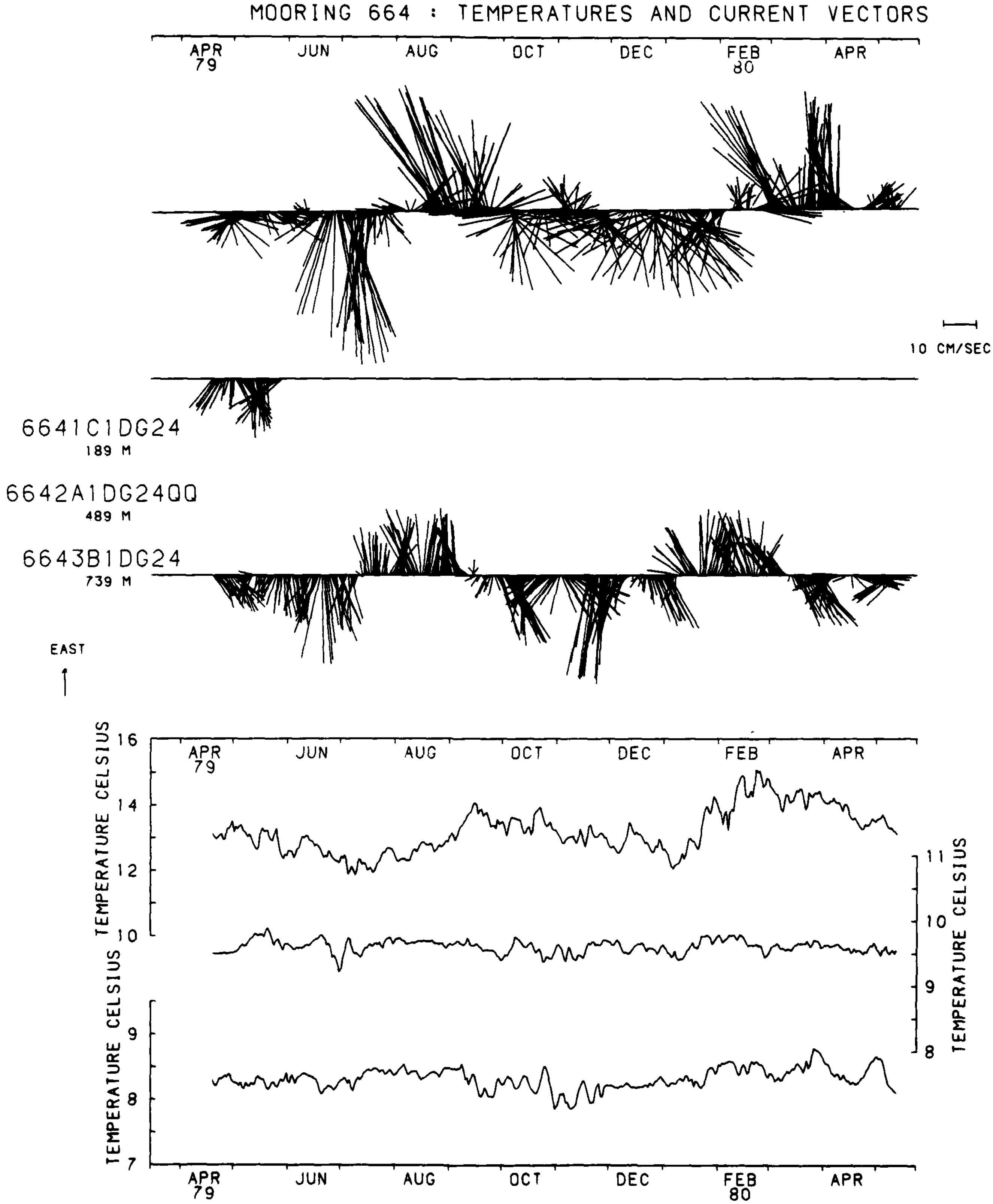

MOORING 664 : TEMPERATURES AND CURRENT VECTORS
APR 79
JUN
AUG
OCT
DEC
FEB 80
APR
10 CM/SEC
6641C1DG24
189 M
6642A1DG24QQ
489 M
6643B1DG24
739 M
EAST
TEMPERATURE CELSIUS
16
14
12
10
11
10
9
8
9
8
7

Figure 19

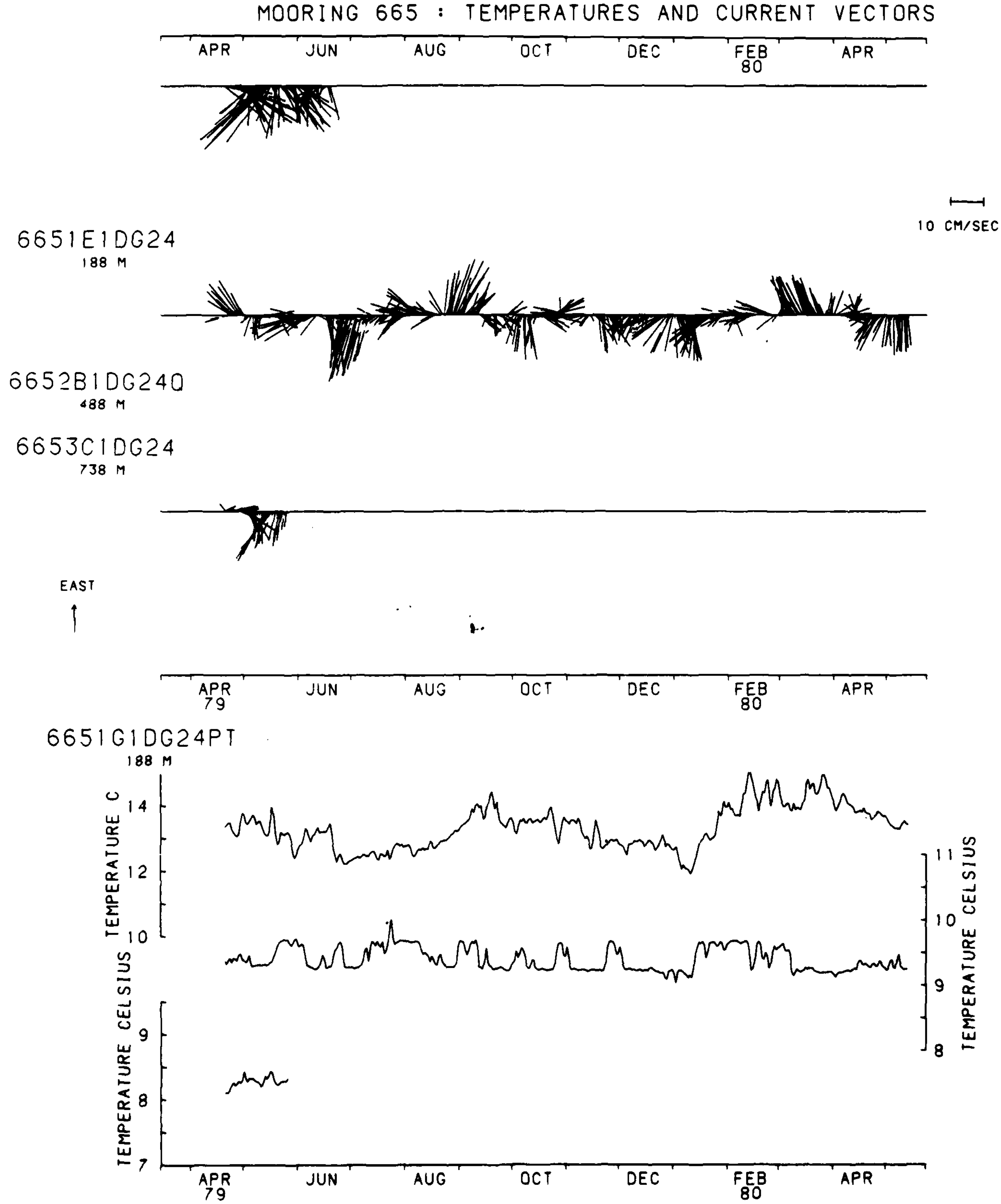

MOORING 665 : TEMPERATURES AND CURRENT VECTORS
APR
JUN
AUG
OCT
DEC
FEB 80
APR
10 CM/SEC
6651E1DG24
188 M
6652B1DG240
488 M
6653C1DG24
738 M
EAST
APR 79
6651G1DG24PT
188 M
TEMPERATURE C
TEMPERATURE CELSIUS
TEMPERATURE CELSIUS
7
8
9
10
12
14
8
9
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Figure 20

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A COMPILATION OF MOORED CURRENT METER DATA, WHITE HORSE PROFILES AND ASSOCIATED OCEANOGRAPHIC OBSERVATIONS, VOLUME XXIX (INDEX 1979) by Ellen Levy, Ann Spencer, Gerald Needell, Gretchen Hund and James R. Luyten. 45 pages, 5 fiche pages. April 1982. Prepared for the Office of Naval Research under Contract N00014-76-C-0197; NR 083-400 and for the National Science Foundation under Grant ATM 78-21491.

Current and temperature measurements are presented from instruments deployed during March and April of 1979 in the western Indian Ocean, between 45°E and 62°E and between 4°S and 4°N. The experiment was part of the INDEX program.

Twelve mooring sites were occupied. A total of thirty current meters were on WHOI moorings at ten of the sites. An experimental inverted echo sounder was on another WHOI mooring, and a French mooring was at the twelfth site. Most of the resulting data records are of fourteen months duration. A current profiler, the White Horse, was also used, and forty-one profiles were taken over a thirteen-week period.

Basic data from the current meters are presented in statistical tables and graphically as scatter plots, progressive vector plots, spectral plots and time series plots. Filtered time series are shown in composite displays. Time series plots are shown for the inverted echo sounder.

Basic White Horse data are presented as east and north velocity component profiles, potential temperature and salinity profiles, and potential temperature versus salinity diagrams.

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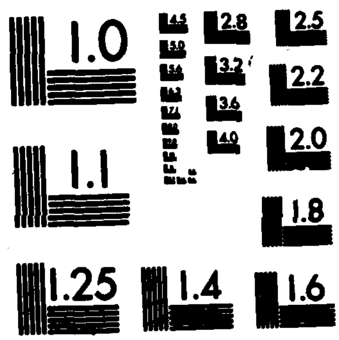

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TO : Recipients of W.H.O.I. Technical Report 82-16, (INDEX 1979)

DATE: November 17, 1982

FROM : Ann Spencer/Jim Luyten

SUBJECT: Acknowledgments

We wish to expand the acknowledgments paragraph to recognize the participation of scientists under the scientific direction of Dr. Joseph Gonella. Please attach the enclosed label on page vi of the report and please accept our apologies for the inconvenience.

In particular we wish to acknowledge the support of the French Administration of "Terres Australes at Antarctiques Françaises". The observational program on board the R/V MARION DUFRESNE was carried out by numerous scientists from the Laboratoire d'Océanographie Physique under the scientific direction of Dr. Joseph Gonella.